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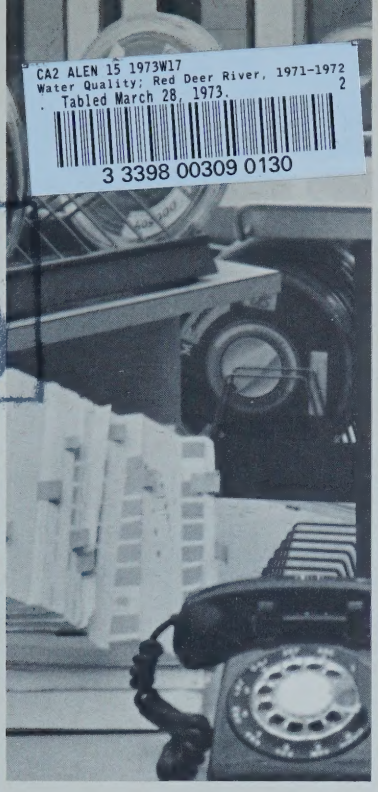

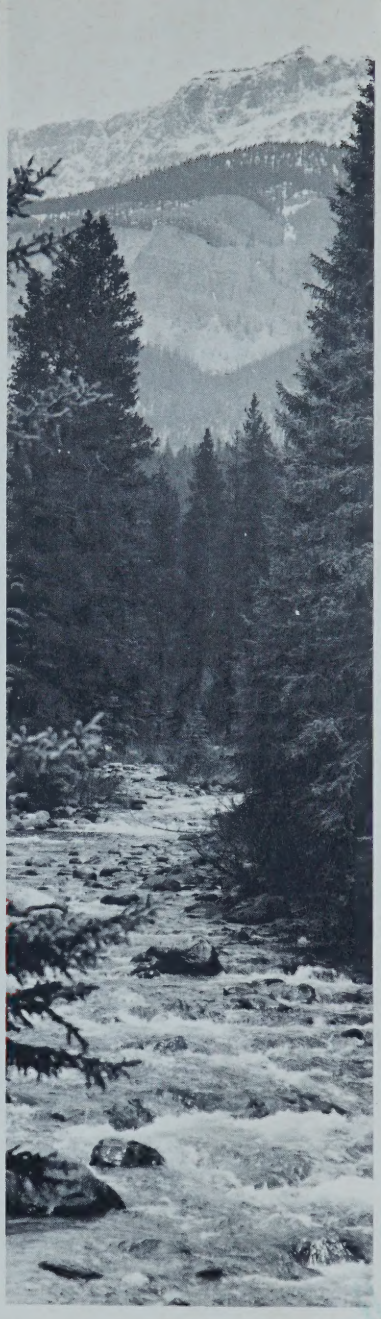

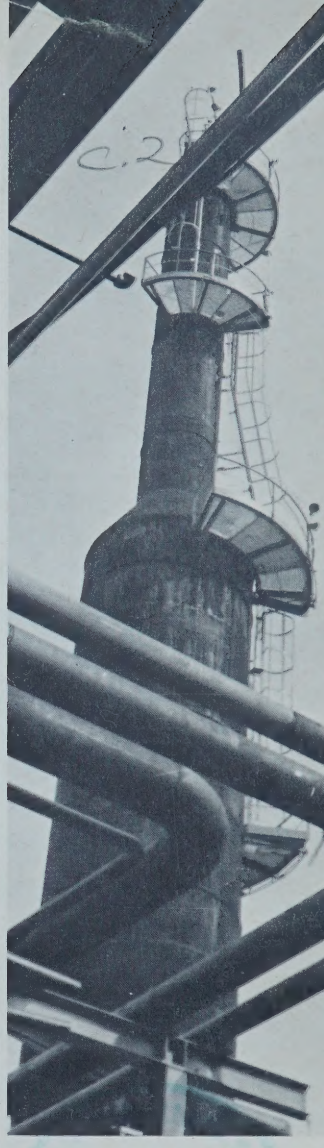

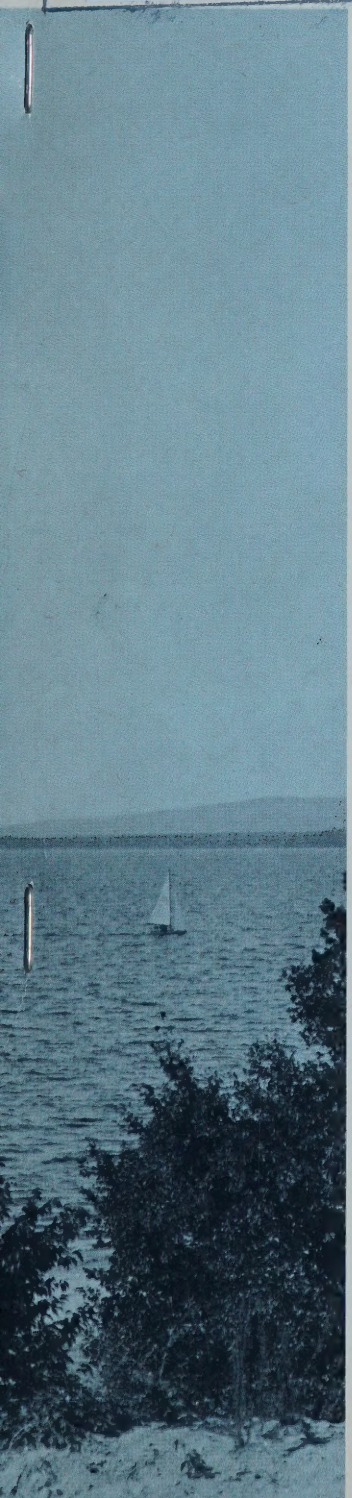

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of the
environment

HON. W. J. YURKO, MINISTER

DR. E. E. BALLANTYNE, DEPUTY MINISTER

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SESSIONAL PAPER 525

WATER QUALITY
RED DEER RIVER
1971 - 1972

TABLED MARCH 28/73.

POLLUTION CONTROL
DIVISION

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SESSIONAL PAPER 525

WATER QUALITY
RED DEER RIVER
1971 - 1972

TABLED MARCH 29/73.

WATER QUALITY

RED DEER RIVER

1971-1972

BY

A. MADUDA, P. ENG.

PROVINCE OF ALBERTA
DEPARTMENT OF THE ENVIRONMENT
DIVISION OF POLLUTION CONTROL
6TH FLOOR MILNER BUILDING, EDMONTON

A B S T R A C T

The water quality in the Red Deer River remained similar to that encountered in previous years.

The problem of low Dissolved Oxygen values below the City of Red Deer was evident again during the 1971-72 sampling season.

The one heavy metals survey taken revealed high levels of some metals, but due to there being only a single survey the values obtained must be reviewed.

TABLE OF CONTENTS

	Page No.
ABSTRACT	i
TABLE OF CONTENTS	iii
ESTABLISHMENT AND OPERATION OF THE PROGRAM	v
INTRODUCTION	1
DISCUSSION -	
Flow Rates in the Red Deer River	2
Pollutant Loadings to the Red Deer River	4
Dissolved Oxygen	4
Nutrients	5
Phenolics	6
Threshold Odour Number	7
Bacteriological Constituents	6
Heavy Metals	6
Summary	7
GLOSSARY	9

ESTABLISHMENT AND OPERATION OF THE PROGRAM

Many of the problems involved in the establishment and operation of the program are of practical rather than technical consideration. A summary discussion of some of the more basic considerations has been included.

PROGRAM OBJECTIVES

This program was established a number of years ago to provide basic information which would reveal pollution trends and provide water quality data for the many existing and prospective users of surface water in Alberta.

The monitoring program has these specific objectives:

1. To determine the chemical, physical, bacteriological and biological characteristics of Alberta's water under changing conditions.
2. To indicate, when possible, the sources of pollution entering a stream.
3. To compile data for future pollution abatement activities.
4. To determine background data on certain types of wastes and to detect critical changes.
5. To obtain data useful for municipal, industrial, agricultural and recreational uses.
6. To procure data useful and necessary for securing public action toward the preservation of streams for all beneficial uses.

SCOPE OF ANALYSES

The frequency of sampling is admittedly limited. In some instances a more important parameter such as dissolved oxygen is monitored continuously. The routine analyses shown in this report represent the minimum of bacteriological, biochemical and chemical analyses which justify the program.

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SAMPLING STATIONS AND PROCEDURES

The following criteria were used as a basis for the selection of monitor stations:

1. Waters used for municipal, industrial, agricultural, and recreational purposes.
2. Near known or suspected sources of pollution.
3. Near the Alberta-Saskatchewan border to determine the quality of water leaving the province.

Stations were established at bridges whenever practical for convenient access to each watercourse. Routine samples included two litres for general chemical analyses, one litre each for Phenolics and Oil and Grease, and 100 millilitres in a sterile bottle for bacteriological analyses. Four litre samples were collected in a pyrex glass jar for Heavy Metals analysis.

INTRODUCTION

The Red Deer River is looked upon by the people of Alberta as a river of many beneficial uses. To the sportsman and naturalist, it provides an area for fishing, boating, and nature study. To the farmer and rancher, it provides water for irrigation and livestock. Municipalities and industries see the river as an economical source of water and as a means of waste disposal.

Strict control must be exercised over all the uses of the river so that certain benefits may not be downgraded by detrimental effects of others.

This report summarizes the water quality of the Red Deer River during the 1971-1972 sampling season and compares the results with the guidelines as set out in "Surface Water Quality Criteria".

D I S C U S S I O N

Water quality surveys on the Red Deer River were carried out on six different occasions throughout the 1971-1972 sampling season. The first survey was conducted in late August under open water conditions, while the remaining five surveys were carried out under winter (ice) conditions. Sampling of the industrial discharges was carried out in conjunction with each river survey.

The following locations were used as points of reference for the collection of samples along the Red Deer River (Figure 1):

1. Bridge - 20 miles west of Bowden
2. Above City of Red Deer - Water Treatment Plant Intake
3. Below City of Red Deer - Burbank
4. Joffre Bridge
5. Above Nevis Gas Plant
6. Above Drumheller - Highway 9 Bridge
7. Below Drumheller - Highway 10 Bridge
8. Highway 36 Bridge
9. Highway 41 Bridge near Empress

FLOW RATES IN RED DEER RIVER

The effect of river flow on water quality is significant when viewing the overall condition of the river. A graphical representation of the statistical distribution of the river flow at the City of Red Deer is depicted in the Appendix. The critical or 1% flow during the 1971-1972 season was 98 c.f.s. This flow is used as a minimum design flow and can be statistically expected to occur for approximately three days per year.

SASKATCHEWAN
ALBERTA
RED DEER RIVER BASIN
WATER SAMPLING LOCATIONS
N
9
8
RIVER
RED DEER
7
DRUMHELLER
DRUMHELLER SEWAGE
6
5
GULF OIL
4
RED DEER SEWAGE
3
2
RED DEER
BLINDMAN RIVER
MEDICINE RIVER
1
RED DEER RIVER
LITTLE
RED DEER
RIVER

FIGURE 1

The daily flow rates of the Red Deer River at Red Deer, Drumheller, and Bindloss are shown in the Appendix. Ice cover at the City of Red Deer commenced October 29, 1971 and lasted until April 13, 1971. The minimum average monthly flow was 172 c.f.s. during December, 1971, down from a minimum flow of 305 c.f.s. recorded in January, 1970 of the previous survey year. A minimum daily flow of 70 c.f.s. was recorded on March 6, 1972.

Any lowering of flow rates at gauging stations below Red Deer (Drumheller and Bindloss) is mainly due to ice build-up in the subsequent reaches of the river between the gauging stations.

POLLUTANT LOADINGS TO THE RED DEER RIVER

The major discharges of waste water to the Red Deer River come from the cities of Red Deer and Drumheller with a minor discharge being introduced by the Gulf Gas Plant at Nevis. The total loadings from these sources are listed in the Appendix. A maximum of 4,270 lbs. of Biochemical Oxygen Demand was discharged to the river during the January 5, 1972 river survey.

A table showing the Red Deer River users and effluent discharges is contained in the Appendix.

DISSOLVED OXYGEN

As in previous years, the major problem with river water quality was low Dissolved Oxygen levels below the City of Red Deer. Dissolved Oxygen levels at the two sampling locations above the City of Red Deer were well above the Surface Water Quality Criteria limit of 5 mg/l.

During the sampling surveys at the Above Red Deer location, the Dissolved Oxygen levels ranged between 13.2 mg/l and 9.0 mg/l.

After the introduction of sewage from the City of Red Deer, the Dissolved Oxygen levels declined rapidly. At the sample station 20 river miles below the City of Red Deer, the levels ranged from 14.6 to 4.3 mg/l, while at the Above Gulf Nevis sampling site 52 river miles below Red Deer, the levels ranged from 14.5 to 1.9 mg/l.

The Dissolved Oxygen values at Drumheller ranged from 15.1 to 2.2 mg/l. Below this location, the effect of the City of Drumheller sewage is an added factor in the lowering of the Dissolved Oxygen levels.

Near the Saskatchewan border at Empress, the Dissolved Oxygen level ranged from 13.8 to 0.4 mg/l. Some recovery of Dissolved Oxygen occurs downstream of Drumheller. During cold weather, the recovery is not great enough to raise the level above 5 p.p.m. by the time the Saskatchewan border is reached.

NUTRIENTS

The baseline level of Ammonia Nitrogen upstream of the City of Red Deer was found to be approximately 0.1 mg/l. The levels increased below the points of municipal discharge but in most cases the level returned to near baseline values at the Saskatchewan border. The maximum value recorded was 1.7 mg/l below Red Deer.

The values of Nitrate plus Nitrite Nitrogen were found to be higher in the lower reaches of the Red Deer River with a maximum

value of 2.4 mg/l at Drumheller. The Surface Water Quality Criteria value of 1.0 mg/l was not exceeded except during the final survey.

The maximum Total Phosphate level observed during the surveys was 1.7 mg/l below Drumheller. Many of the samples including some taken above major effluent contaminations exceeded the Surface Water Quality Criteria level of 0.15 mg/l.

PHENOLICS

The range of Phenolic concentration measured during the surveys was from .000 to .028 mg/l. Although there were some high levels of Phenolics monitored, the majority of the values measured were at or below the Surface Water Quality Criteria value of 5 p.p.b.

THRESHOLD ODOR NUMBER

Except for one sample, the Threshold Odor Numbers monitored were at or below the acceptable limit of 8.

BACTERIOLOGICAL CONSTITUENTS

The values of bacteriological constituents (Total Coliform and Faecal Coliform) measured during this year's survey started well within the Surface Water Quality Criteria limits.

HEAVY METALS

Since there was only one survey completed during the 1970-1971 year, no definitive conclusions can be made of the Heavy Metal results. The overall values of Heavy Metals exceeded the limits in a number of

cases. These high levels of metals do not correlate with the effluent discharges and the Heavy Metal sampling on the Red Deer River will be reviewed.

SUMMARY

The problem of low Dissolved Oxygen levels below Red Deer City was evident again this year. The problems of oxygen demanding loadings to the river, river sensitivity to organic loadings, and low concentrations of Dissolved Oxygen upstream of Red Deer were the major contributing factors to these low levels.

The City of Red Deer is presently in the process of constructing secondary sewage treatment facilities which should considerably improve the quality of the effluent discharged to the river. The plant is to be put into operation during the summer of 1973 and the effect on the river should be observed during the 1973 and 1974 sampling season.

The U-Tube re-aeration project located at the Below Red Deer sampling site was slated for operation during the 1971-72 winter season, but due to innumerable construction problems and equipment delays, it was not put into operation except for a brief test period. It is hoped that during the 1972-1973 winter season, the project will be fully operational and the feasibility of re-aeration can be measured.

One of the sampling surveys was conducted on March 22, 1972, when runoff from spring melting was prevalent throughout the Red Deer River basin. The effects of the natural pollution caused by runoff can be seen in the chemical analysis. The majority of the parameters

analyzed had values much higher than normal. The higher values obtained on this survey had a marked effect on the overall statistical review of the analysis.

GLOSSARY

WATER POLLUTION CONTROL TECHNOLOGY

This is a selected list containing the key terms likely to be encountered in water pollution control technology.

ABSORPTION - The taking up of one substance into the body of another.

ACID - Most commonly refers to a large class of chemicals having a sour taste in water, ability to dissolve certain metals, bases or alkalies to form salts and to turn certain acid-base indicators to their acid form. Characterized by the hydrated H^+ion.

ADSORPTION - The taking up of one substance upon the surface or interface zone of another substance.

ADVANCED WASTE TREATMENT - Renovation of used water by biological, chemical or physical methods that are applied to upgrade water quality for specific re-use requirements. May include more efficient cleanup of a general nature or the removal of components that are inefficiently removed by conventional treatment processes.

AERATION - The operation of adding oxygen to, removing volatile constituents from, or mixing a liquid by intimate contact with air.

AEROBIC - A condition characterized by an excess of dissolved oxygen in the aquatic environment.

AEROBIC BACTERIA - Organisms that require dissolved oxygen in the aquatic environment to enable them to metabolize or to grow.

ALGAE - Primitive plants, one or many celled, usually aquatic and capable of growth on mineral materials via energy from the sun and the green coloring material, chlorophyll. Generally considered as the primary source of food for all other organisms.

ALKALINITY - A term used to represent the sum of the effects opposite in reaction to acids in water. Usually due to carbonates, bicarbonates, and hydroxides; also including borates, silicates and phosphates.

ANAEROBIC - A condition in which dissolved oxygen is not detectable in the aquatic environment. Commonly characterized by the formation of reduced sulfur compounds from the use of bound oxygen from sulfates as a hydrogen acceptor.

ANAEROBIC BACTERIA - Organisms that can metabolize and grow in the absence of dissolved oxygen. Their oxygen supply is obtained from the bound oxygen such as in sulfates, carbonates, or other oxygen-containing compounds.

ANION - A negatively charged ion in water solution. May be a single element or a combination of elements, such as the Cl^- ion in a water solution of NaCl (common table salt) or $SO_4^=$ ion in a sulfuric acid solution.

ASSESSMENT - A legal financial obligation of the property owner in an irrigation, water, drainage or sanitary district, created for the purpose of financing the construction and operation of facilities required to protect and enhance public benefit within the district.

BACTERIA - Primitive organisms having some of the features of plants and animals. Generally included among the fungi. Usually do not contain chlorophyll, hence commonly require preformed organic nutrients among their foods. May exist as single cells, groups, filaments, or colonies.

BENTHIC DEPOSIT (BENTHOS) - Refers to the accumulated deposition of cell mass living or dead that collects at the bottom of a stream impoundment where velocity or catchment permits.

BIO-CHEMICAL - Resulting from the combined activities of biological and chemical transformations. Usually measured in terms of the ensuing chemical changes.

BIODEGRADATION - The stabilization of waste water contaminants by biological conversion of pollutants into separable materials at a higher oxidation state.

BIOLOGICAL PROCESSES - Activities of living organisms to sustain life, growth, and reproduction. Commonly the processes by which organisms degrade complex organic material into simpler substances at a higher oxidation state to obtain energy for life processes and growth of new cell mass.

B.O.D. - Biological or biochemical oxygen demand. A test for estimation of waste water polluting effects in terms of the oxygen requirements for biochemical stabilization under specified conditions and time.

BUFFER ACTION - An action exhibited by certain chemicals that limits the change in pH upon addition of acid or alkaline materials to the system. In surface water, the primary buffer action is related to carbon dioxide, bicarbonate and carbonate equilibria.

CARBOHYDRATES - Naturally occuring compounds consisting of carbon, hydrogen, and oxygen, that are considered as energy foods and precursors of proteins and fats in the natural food chain.

CATION - A positively charged ion in water solution. May be a single element or a combination of elements, such as Na^+ in a water solution of NaCl (common table salt).

CHLOROPHYLL - The green coloring material or pigments in plants that promote the photosynthetic reactions forming organic materials from inorganic nutrients and light energy within the living cells.

CLARIFIER - A basin or chamber serving as an enlargement of a channel to reduce flow velocity sufficiently to permit separation of settleable or floatable materials from the carrier water (a sedimentation basin).

COAGULANT - A chemical, or chemicals, which when added to water suspensions will cause finely dispersed materials to gather into larger masses of improved filterability, settleability, or drainability.

COAGULATION - The process of modifying chemical, physical, or biological conditions to cause flocculation or agglomeration of particulates.

C.O.D. - A test for the estimation of the contamination of a waste water in terms of oxygen requirements from a strong chemical oxidant under specified conditions, i.e., Dichromate, 50% sulfuric acid and 145°C for two hours.

COLIFORM GROUP - A group of bacteria that inhabits the intestinal tracts of man, warm-blooded animals, and may be found in plants, soil, air, and the aquatic environment. Includes aerobic and facultative gram negative non-spore forming bacilli that ferment lactose with gas formation.

COLLOID, COLLOIDAL STATE - A state of suspension in which the particulate or insoluble material is in a finely divided form that remains dispersed in the liquid for extended time periods. Usually cloudy or turbid suspensions requiring flocculation before clarification.

CONCENTRATION -

a) The act of increasing the mass per unit volume of one substance with respect to another, such as concentrating the solids in a sludge from 3% to 6%.

b) A means of designating the ratio of one substance with respect to another, such as 15 mg of suspended solids per liter of water.

CRITERION (pl. CRITERIA) - Something which can be measured. Commonly used as a basis for standards.

CUBIC FOOT PER SECOND (c.f.s.) - A unit of discharge rate such as one cubic foot of water per second past a given point.

DATA - Records of observations or measurements of facts, occurrences and conditions in written, graphical or tabular form.

DEGRADE - To reduce the complexity of a chemical compound.

DENITRIFICATION -

a) The conversion of oxidized nitrogen (nitrate and nitrite-N) to nitrogen gas by contact with septic waste water solids or other reducing chemicals.

b) A reduction process with respect to oxidized nitrogen.

DETERGENT - Something used for cleaning. Commonly consists of soap or surfactant plus various additives or associated materials.

DILUTION -

a) To make thinner or more liquid.

b) A ratio, volume, or weight or a more concentrated sample or effluent flow compared to that into which it is discharged.

DISSOLVED -

a) Those materials dispersed in water in ionic, atomic, or molecular form; an homogenous mixture or solution.

b) Generally clear but may be colored.

c) Present in true solution form.

DISSOLVED OXYGEN (D.O.) - Dissolved molecular oxygen usually expressed in mg DO/l or percent of saturation.

ECOLOGY - The relation of an organism to its environment, i.e. how an organisms is affected by its surroundings such as air, water, heat, noise, contamination, etc.

EFFLUENT - A liquid or product water discharged from a chamber, basin, or other treatment operation.

ENTERIC ORGANISMS - Those organisms commonly associated with the intestinal tract.

ENTRAINMENT - A condition or action that will cause an immiscible substance to be mixed with another. Usually the result of turbulence or entrapment, i.e., air bubbles in aqueous media.

ENZYME - A soluble or colloidal organic catalyst produced by a living organism. Usually they are simple or conjugated proteins that catalyze specific reactions.

EUTROPHIC - Well nourished; rich in dissolved nutrients.

EUTROPHICATION - An action involving the aging of lakes characterized by nutrient enrichment and increasing growth of plant and animal organisms. The net effect is to decrease depth until the lake becomes a bog and eventually dry land. Man-made pollution tends to hasten the process.

FACULTATIVE BACTERIA - Bacteria that can adapt themselves to growth and metabolism under aerobic or anaerobic conditions. Many organisms of interest in waste water stabilization are among this group.

FLOC - Gelatinous or amorphous solids formed by chemical, biological, or physical agglomeration of fine materials into larger masses that are more readily separated from the liquid.

FUNGI - Simple or complex organisms without chlorophyll. The simpler forms are one-celled; higher forms have branched filaments and complicated life cycles. Examples are molds, yeasts and mushrooms.

SECONDARY TREATMENT - Processes used to convert dissolved and colloidal materials in waste water to a form that may be separated from the water. Commonly consists of biodegradation and conversion to cell mass in a separable form with partial oxidation, such as in activated sludge, trickling filtration, or oxidation ponds.

SETTLEABLE SOLIDS -

a) Includes materials that will settle by gravity under low flow velocities.

b) Commonly expressed in terms of the volume of solids accumulating in an Imhoff cone after one hour on a volume basis.

SEWER - A pipe or conduit, generally covered, for the purpose of conveying waste waters from the point of origin to a point of treatment or discharge.

SEWERAGE SYSTEM - A system of sewers and appurtenances for the collection, transportation and pumping of used waters for a given area or basin. Any treatment device or facility and its outfall conduit are a part of the system.

SLIME-SEWAGE SLIMES - Consisting of organisms growing on waste water nutrients with the formation of mucilaginous covering, streamers or clumps. May consist of bacteria, molds, protozoa or algae.

STABILIZATION -

a) The activity proceeding along the pathway to stability.

b) In organic wastes, generally refers to oxidation via biochemical pathways and conversion to gaseous or insoluble materials relatively inert to further change.

STANDARD - Something set by authority. Having qualities or attributes required by law and defined by minimum or maximum limits of acceptability in terms of established criteria or measurable indices.

STANDARD METHODS - Methods of analysis prescribed by joint action of APHA, ASCE, AWWA, and FWPCA. Methods accepted by authority.

SUBSTRATE -

a) The base or media in which an organism lives.

b) The liquid in an activated sludge aeration tank.

SURFACTANT -

a) A chemical that, when added to water, will greatly reduce the surface tension of the solution.

b) The surface active component in a detergent mixture.

SUSPENDED SOLIDS - The concentration of insoluble materials suspended or dispersed in waste or used water. Generally expressed in mg/liter on a dry weight basis. Usually determined by filtration methods.

HARDNESS - Commonly refers to the chemicals interfering with soap action or producing scale in boilers or heating units. Specifically refers to Calcium and Magnesium salts; sometimes including iron, aluminum, and silica.

INDICATOR - May include the color change of a dye, electronic sensor response, or other means of estimating the equivalence point of a reaction between two different materials.

INFLUENT - That material entering a process unit or operation.

INORGANIC - Being composed of material other than plant or animal materials. Forming or belonging to the inanimate world.

LAGOON - A natural or artificial basin used for storage and/or stabilization of waste water or sludge. Sometimes used for indefinite storage for disposal purposes. Commonly the lagoon depth is greater than a wadeable depth but not greater than twenty feet.

LOAD - The load to a process is that which is contained in the inflow to that process. It may be expressed as hydraulic, oxygen demand, solids or other criteria.

MICRO ORGANISMS - Commonly an organism too small to be observed individually by the human eye without optical aid.

MG/L - A unit of concentration on a weight/volume basis: milligrams per liter. Equivalent to ppm when the specific gravity of the liquid is 1.0.

MIXING ZONE - An area where two or more substances of different characteristics blend to form a uniform mixture, i.e., chlorine application, heated water, or other discharged materials entering a water mass will show significant differences of chlorine residual, temperature or other criteria, depending upon the sampling location throughout the mixing zone and approach uniform results with respect to lateral, longitudinal, and vertical sampling positions when mixing has been completed.

MOST PROBABLE NUMBER (MPN) - A statistical method of determining microbial populations. A multiple dilution tube technique is utilized with a standard medium and observations are made for specific individual tube effects. Resultant coding is translated by mathematical probability tables into population numbers.

NITRIFICATION - The biochemical conversion of unoxidized nitrogen (ammonia and organic N) to oxidized nitrogen (usually nitrate).

NUTRIENTS -

a) Anything essential to support life.

b) Includes many common elements and combinations of them. The major nutrients include carbon, hydrogen, oxygen, nitrogen, sulfur, and phosphorus.

c) Nitrogen and phosphorus are of major concern because they tend to recycle and are hard to control.

OILS -

a) Liquid fats of animal or vegetable origin.

b) Oily or waxy mineral oils.

OXIDATION POND - A shallow basin employed for the stabilization of waste water.

OXYGEN DEPLETION - The loss of oxygen from water or sewage due to biological, chemical or physical action.

PARASITE - A living organism deriving its nutrients at the expense of another living organism, giving nothing in return.

PARSHALL FLUME - A device for estimation of the flow in an open conduit. Consists of a constructing section, a throat, and an expanding section. The throat contains a sill over which the liquid passes. The pressure change over the sill can be related to quantity of flow.

PARTS PER MILLION (PPM) - A unit of concentration signifying parts of some substances per million parts of dispersing medium. Equivalent numerically to mg/l only when the specific gravity of the solution is 1.0.

PATHOGENIC ORGANISMS - Bacterial, fungal, viral, or other organisms directly involved with diseases of plants, animals, or man, are included among this group.

pH - An index of hydrogen ion activity. Defined as the negative logarithm (base 10) of H^+ ion concentration at a given instant. On a scale of 0 to 14 pH 7.0 is neutral; pH less than 7.0 indicates a predominance of H^+ or acid ions; pH greater than 7.0 indicates a predominance of OH^- or alkaline ions.

POLLUTION - Anything appearing in water that renders it unacceptable in terms of established water quality standards. Commonly, conditions or contaminants that interfere with subsequent beneficial uses of water.

PRIMARY TREATMENT - Commonly the separation of settleable or floatable materials from carrier water. Usually preceded by pre-treatment such as coarse screens, grit separation, comminution.

SATURATION - Commonly refers to the maximum amount of any material that can be dissolved in water or other liquid at a given temperature and pressure. For oxygen, this commonly refers to a percentage saturation in terms of the saturation value, such as about 9 mg O_2/l at 20°C.

SECOND FOOT - An abbreviation for cubic foot per second. A rate term.

SYNERGISM - Refers to the action produced when two or more substances in combination have a greater effect than that produced by the additive effects of each one separately.

THERMAL POLLUTION - Refers to heated discharges to surface waterways. The largest contributor of heated discharges is associated with power production.

T.O.C. - Total Organic Carbon. A test expressing waste water contaminant concentration in terms of the carbon content.

TOTAL SOLIDS - Refer to the solids contained in dissolved and suspended form in water. Commonly determined on a weight basis by evaporation to dryness.

VELOCITY (FLOW) - A rate term expressed in terms of linear movement per unit of time. Commonly expressed in ft. per sec. (English) or cm/sec (Metric).

VOLATILE MATERIAL -

a) Refers to those chemicals having a vapor pressure low enough to evaporate from water readily at normal temperatures.

b) With reference to dry solids, the term includes loss in weight upon ignition at 600°C.

WATER QUALITY CRITERIA - Includes selected analytical measurements with limits designated to be acceptable or unacceptable in reference to water quality standards.

WATER QUALITY STANDARDS - Limits set by authority on the basis of water quality criteria required for beneficial uses.

WASTE WATER - Refers to the used water of a community. Generally contaminated by the waste products from household, commercial or industrial activities. Often contains surface wash, storm water and infiltrations water.

INDEX TO APPENDICES

APPENDIX A

RED DEER RIVER DAILY FLOW RATE AT RED DEER A-1

RED DEER RIVER DAILY FLOW RATE AT DRUMHELLER A-2

RED DEER RIVER DAILY FLOW RATE AT BINDLOSS A-3

STATISTICAL FLOW ANALYSIS OF THE RED DEER RIVER AT RED DEER. A-4 & A-5

RED DEER RIVER USERS AND EFFLUENT DISCHARGES A-6

TOTAL LOADINGS TO THE RED DEER RIVER A-7

MAXIMUM, MEDIAN, AND MINIMUM VALUES FOR -

- Dissolved Oxygen A-8
- Biochemical Oxygen Demand A-9
- Ammonia Nitrogen A-10
- Nitrate and Nitrite Nitrogen A-11
- Phosphates A-12

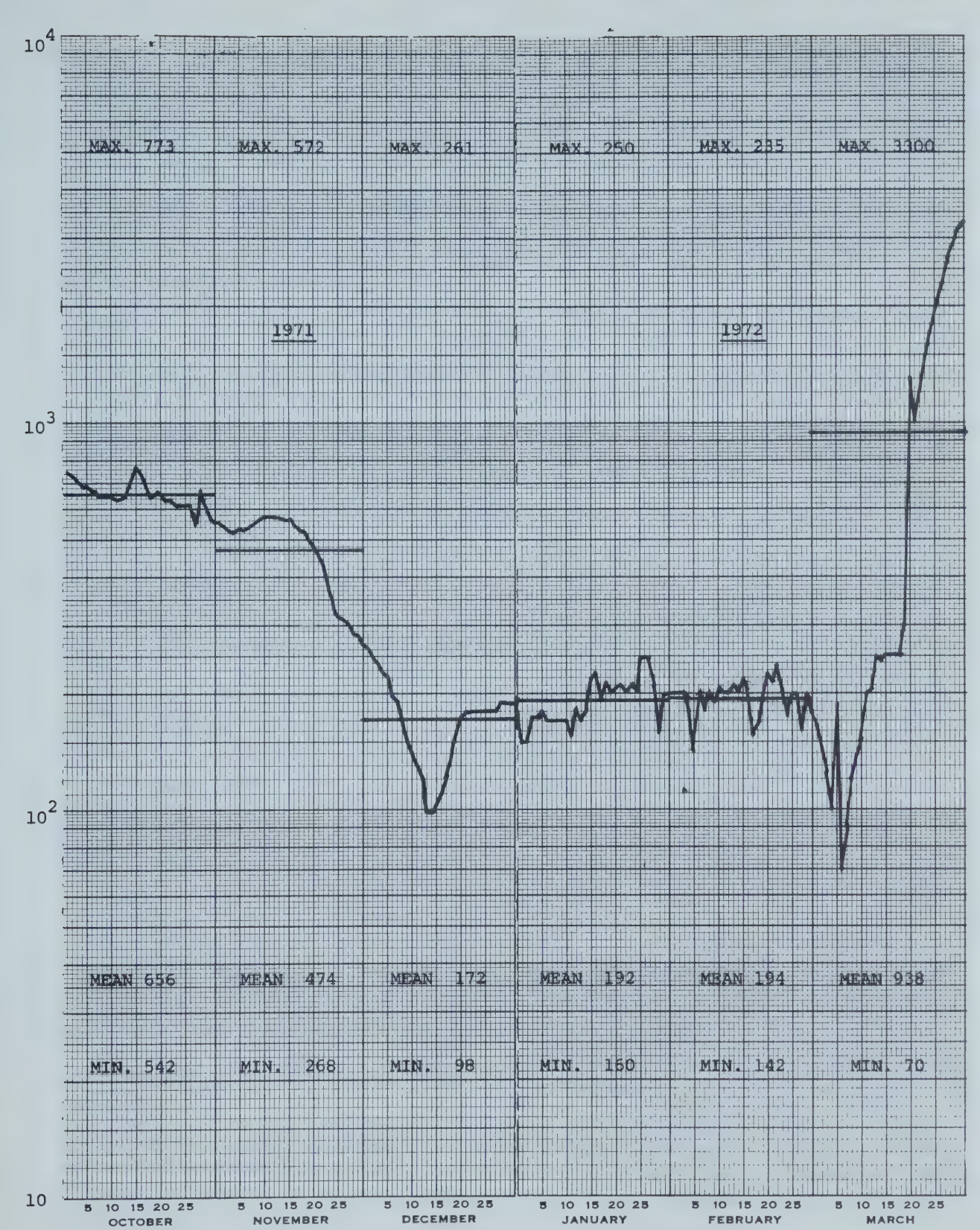
APPENDIX B

ANALYTICAL DATA -

- Red Deer River West of Bowden B-1
- Red Deer River Above Red Deer B-2
- Red Deer River at Burbank B-3
- Red Deer River Below Red Deer B-4
- Red Deer River 21 Miles East of Red Deer B-5
- Red Deer River Above Gulf, Nevis B-6
- Red Deer River Above Drumheller B-7
- Red Deer River Below Drumheller B-8
- Red Deer River at Highway 36 . . . . . B-9
- Red Deer River at Empress B-10

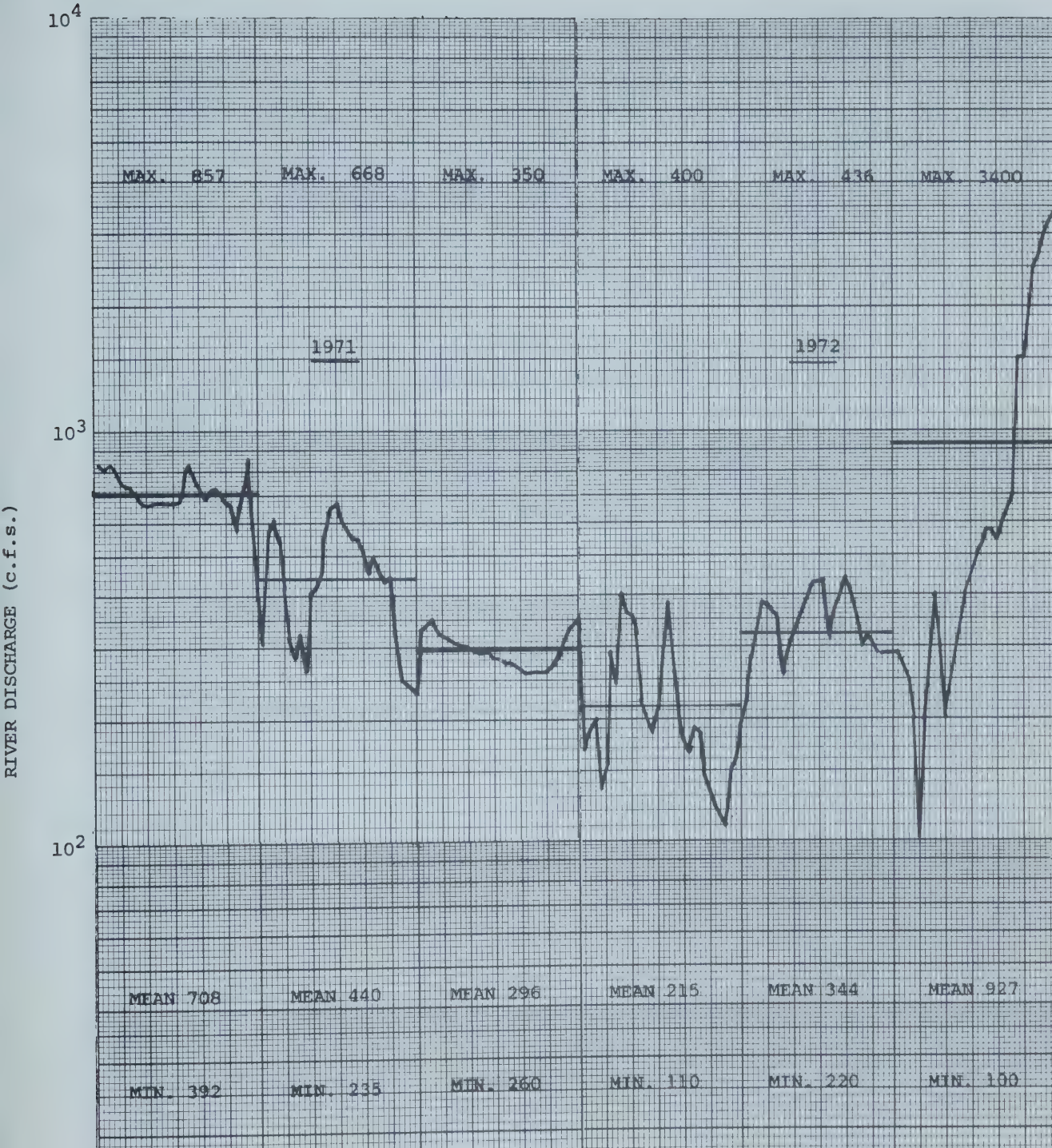
RIVER CONSTITUENT PROFILES . . . . . B-11 to B-22

APPENDIX A



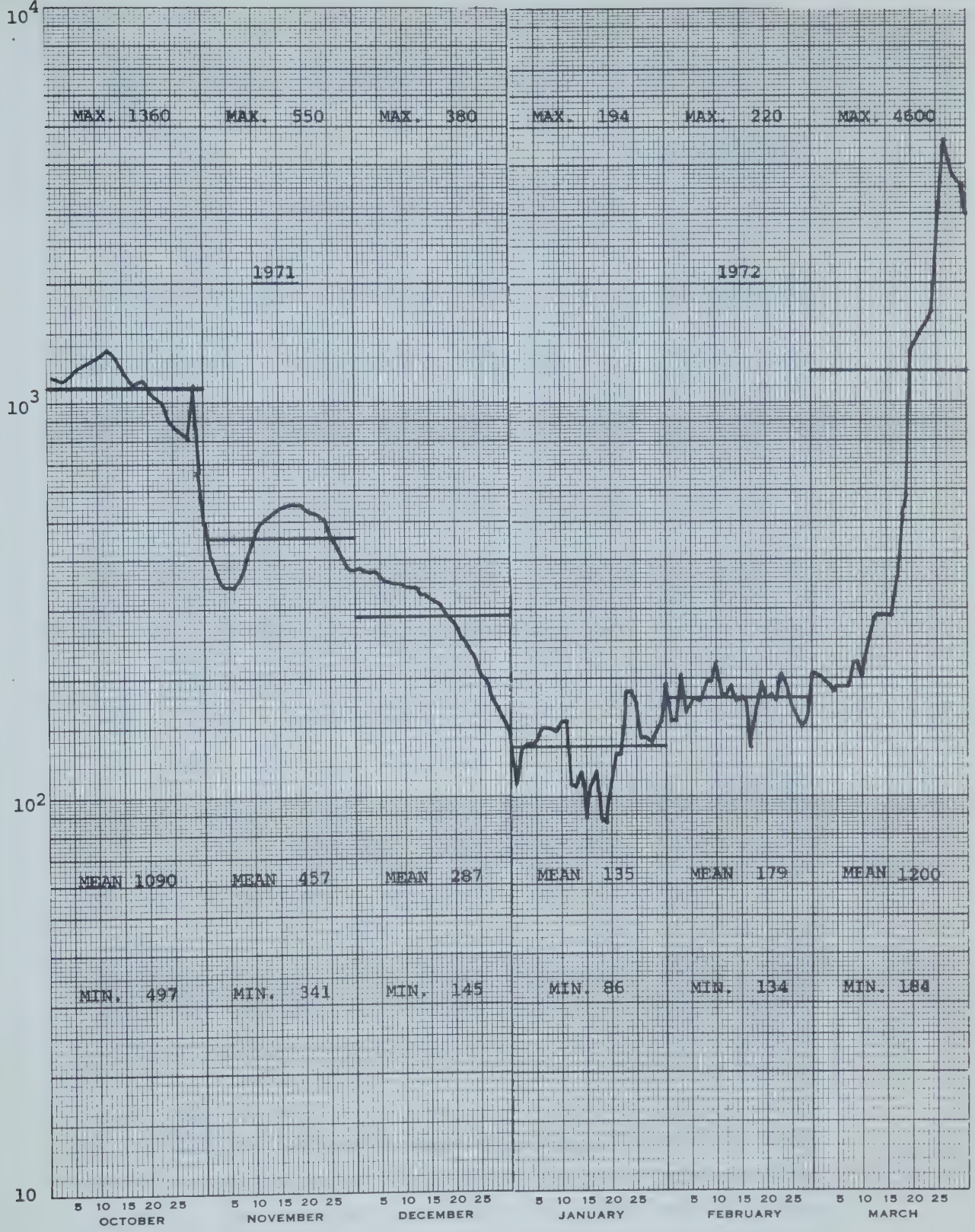
STATION NO. 05CC002

RED DEER RIVER AT RED DEER



STATION NO. 05CE001

RED DEER RIVER AT DRUMHELLER



STATION NUMBER 05CK004

RED DEER RIVER AT BINDLOSS

STATISTICAL FLOW ANALYSIS FOR THE RED DEER RIVER AT RED DEER

1956 - MARCH 1972

THERE ARE 5935 PIECES OF DATA

THE MINIMUM FLOW IS 70 CUBIC FEET PER SECOND

1%	OF THE TIME THE FLOW IS LESS THAN	168 CUBIC FEET PER SECOND
5%	OF THE TIME THE FLOW IS LESS THAN	218 CUBIC FEET PER SECOND
10%	OF THE TIME THE FLOW IS LESS THAN	251 CUBIC FEET PER SECOND
20%	OF THE TIME THE FLOW IS LESS THAN	315 CUBIC FEET PER SECOND
30%	OF THE TIME THE FLOW IS LESS THAN	395 CUBIC FEET PER SECOND
40%	OF THE TIME THE FLOW IS LESS THAN	592 CUBIC FEET PER SECOND
50%	OF THE TIME THE FLOW IS LESS THAN	817 CUBIC FEET PER SECOND
60%	OF THE TIME THE FLOW IS LESS THAN	1110 CUBIC FEET PER SECOND
70%	OF THE TIME THE FLOW IS LESS THAN	1580 CUBIC FEET PER SECOND
80%	OF THE TIME THE FLOW IS LESS THAN	2300 CUBIC FEET PER SECOND
90%	OF THE TIME THE FLOW IS LESS THAN	3370 CUBIC FEET PER SECOND

THE MAXIMUM FLOW IS 29,700 CUBIC FEET PER SECOND

APRIL 1971 - MARCH 1972

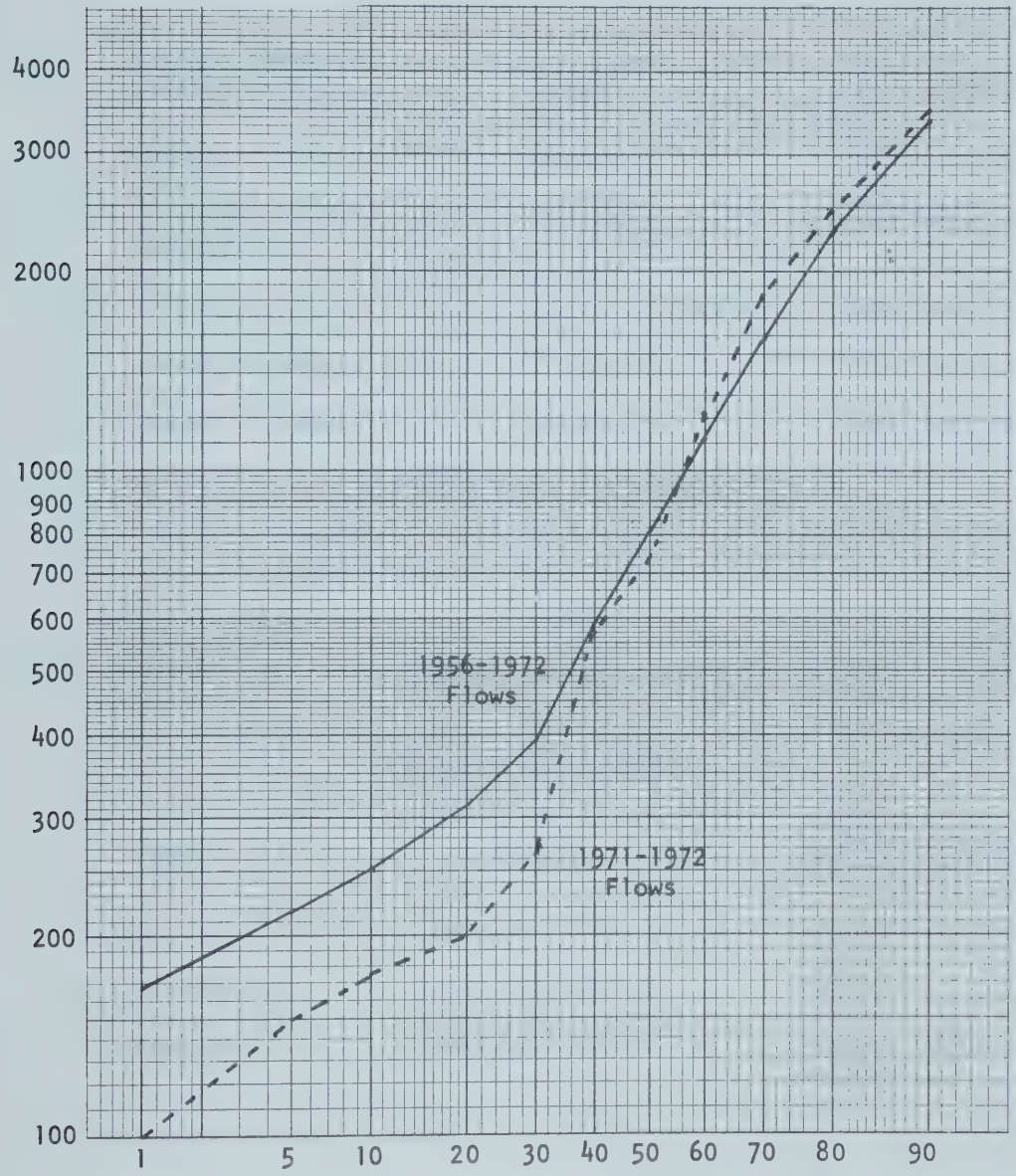
THERE ARE 366 PIECES OF DATA

THE MINIMUM FLOW IS 70 CUBIC FEET PER SECOND

1%	OF THE TIME THE FLOW IS LESS THAN	98 CUBIC FEET PER SECOND
5%	OF THE TIME THE FLOW IS LESS THAN	150 CUBIC FEET PER SECOND
10%	OF THE TIME THE FLOW IS LESS THAN	175 CUBIC FEET PER SECOND
20%	OF THE TIME THE FLOW IS LESS THAN	200 CUBIC FEET PER SECOND
30%	OF THE TIME THE FLOW IS LESS THAN	268 CUBIC FEET PER SECOND
40%	OF THE TIME THE FLOW IS LESS THAN	572 CUBIC FEET PER SECOND
50%	OF THE TIME THE FLOW IS LESS THAN	741 CUBIC FEET PER SECOND
60%	OF THE TIME THE FLOW IS LESS THAN	1200 CUBIC FEET PER SECOND
70%	OF THE TIME THE FLOW IS LESS THAN	1840 CUBIC FEET PER SECOND
80%	OF THE TIME THE FLOW IS LESS THAN	2490 CUBIC FEET PER SECOND
90%	OF THE TIME THE FLOW IS LESS THAN	3500 CUBIC FEET PER SECOND

THE MAXIMUM FLOW IS 11,600 CUBIC FEET PER SECOND

STATISTICAL FLOW ANALYSIS OF THE RED DEER RIVER AT RED DEER



FREQUENCY OF OCCURRENCE LESS THAN INDICATED (PER CENT)

1956 - March 1972 Maximum Flow - 29,700 c.f.s.
Minimum Flow - 70 c.f.s.

April 1971 - March 1972 Maximum Flow - 11,600 c.f.s.
Minimum Flow - 70 c.f.s.

RED DEER RIVER USERS AND EFFLUENT DISCHARGERS

	Type of Discharge and Treatment	Source	Discharged to
1.	Domestic Sewage - P	Sundre	Red Deer River
2.	Domestic Sewage - L (aerated)	Red Deer	Red Deer River
3.	Industrial Waste - L	Gulf Oil Canada	Red Deer River
4.	Domestic Sewage - L	Drumheller	Red Deer River
5.	Domestic Sewage - L	Empress	Red Deer River

P - Primary

L - Lagoons

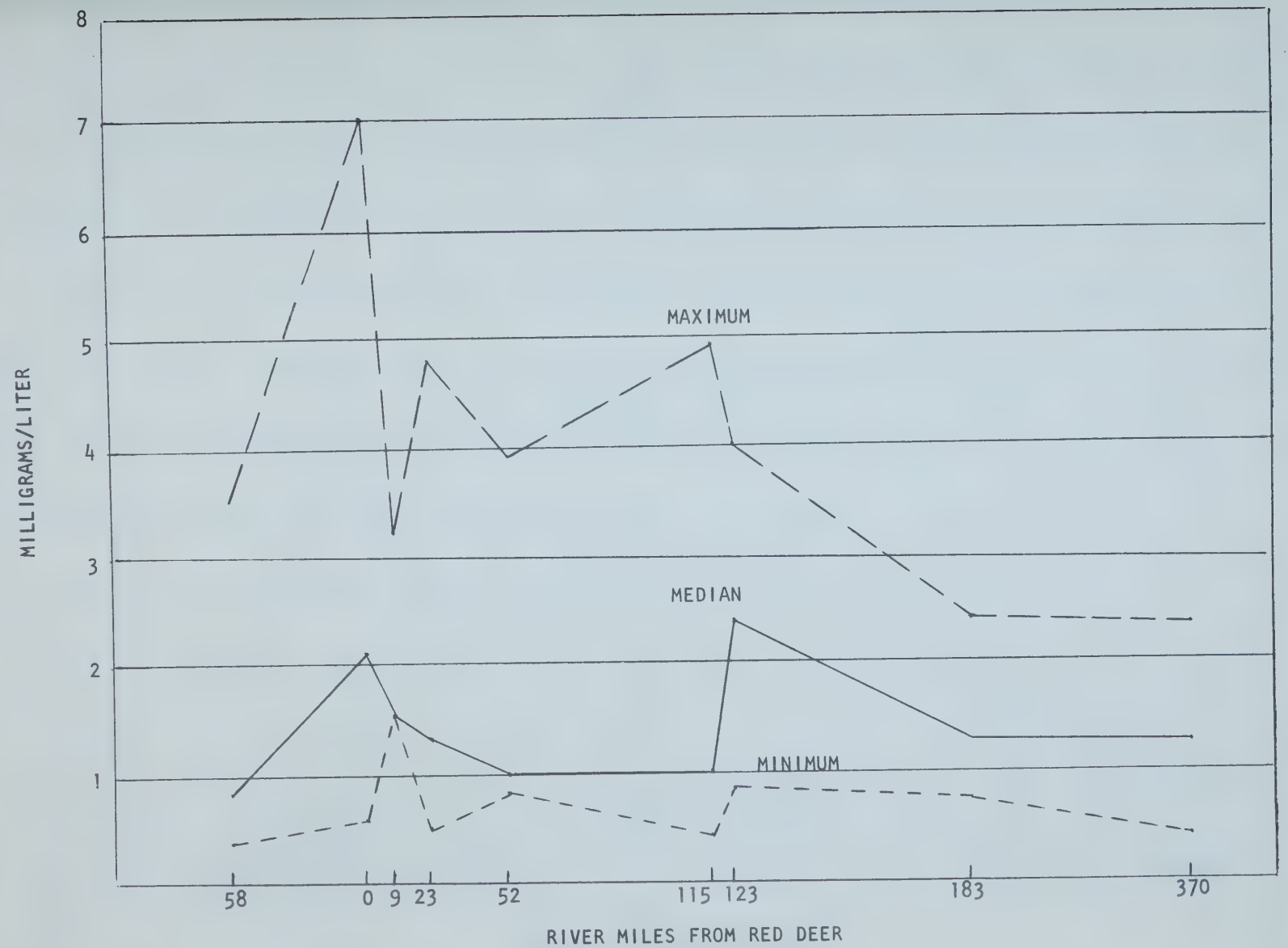
DRINKING WATER USERS

	User	Source	Type of Treatment
1.	Red Deer	Red Deer River	Complete & Softening
2.	Drumheller	Red Deer River	Complete
3.	Empress	Red Deer River	Natural Infiltration Gallery

TOTAL LOADINGS TO THE RED DEER RIVER

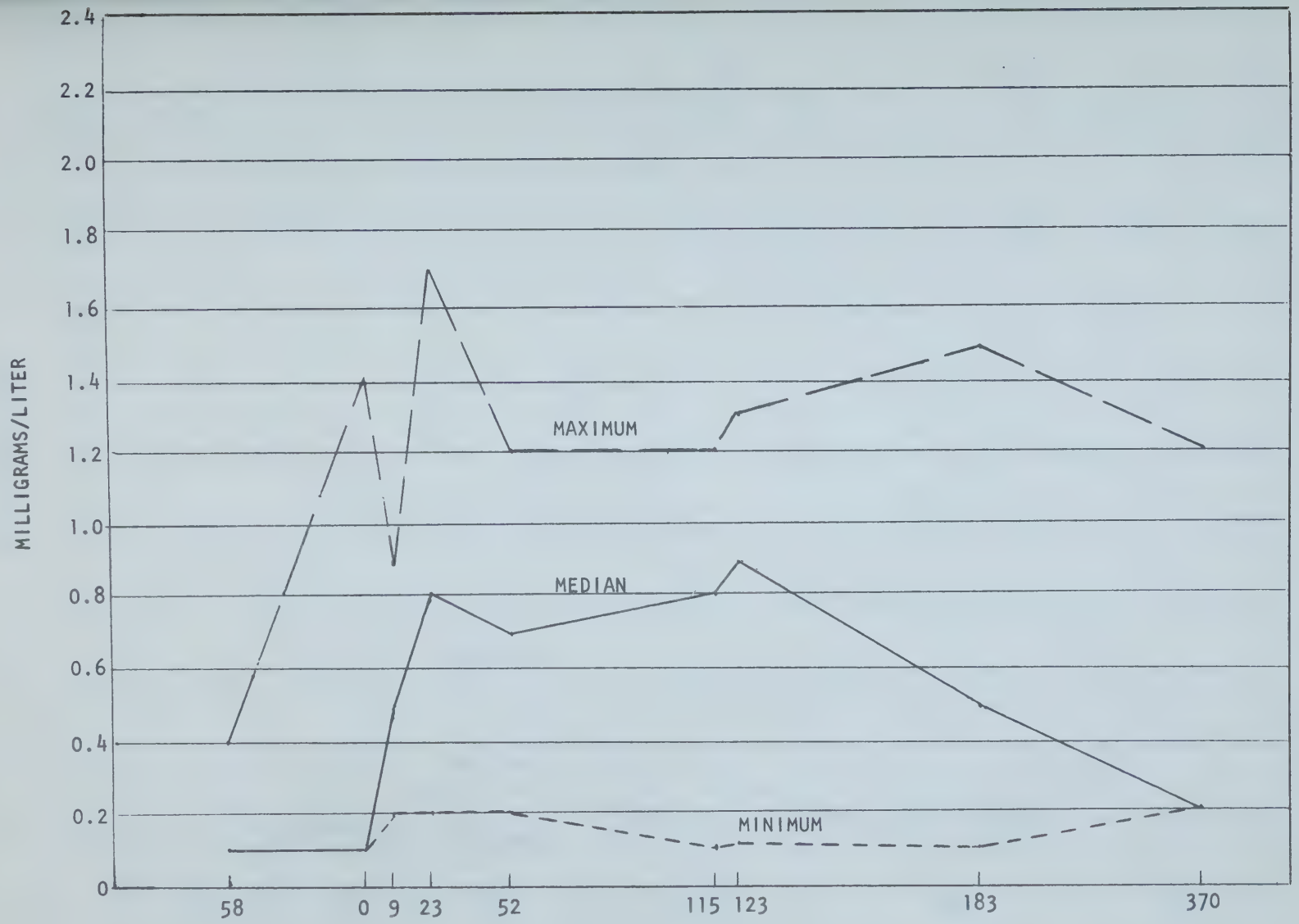
(lbs/day)

	Nov. 16/71	Nov. 30/71	Jan. 5/72	Feb. 15/72	Mar. 21/72
BIOCHEMICAL OXYGEN DEMAND	1,940	1,890	4,270	3,550	1,415
CHEMICAL OXYGEN DEMAND	5,180	5,850	1,850	9,320	5,450
ALKALINITY pp as $CaCO_3$	0	0	0	0	0
TOTAL ALKALINITY as $CaCO_3$	10,200	15,400	9,140	8,750	8,230
TOTAL RESIDUE	16,000	16,650	16,130	17,600	15,550
IGNITION LOSS	4,190	3,730	6,145	6,450	5,590
NON-FILTRABLE RESIDUE	800	1,420	3,800	2,410	2,240
IGNITION LOSS	465	1,125	2,850	1,970	1,740
OILS AND GREASE	80	190	647	-	-
PHENOLS	1.3	.5	2.6	1.3	1.5
CHLORIDES	3,030	2,880	2,950	1,860	2,350
TOTAL PHOSPHOROUS as PO_4	975	1,060	837.6	730	625
AMMONIA NITROGEN	1,100	2,640	1,085	1,105	1,250
NITRATE NITROGEN	14	.5	3	3	6
SULPHATES	10	10	3,200	1,550	1,630
IRON DISSOLVED	-	-	17	-	-
NUMBER OF EFFLUENTS	3	3	3	3	2



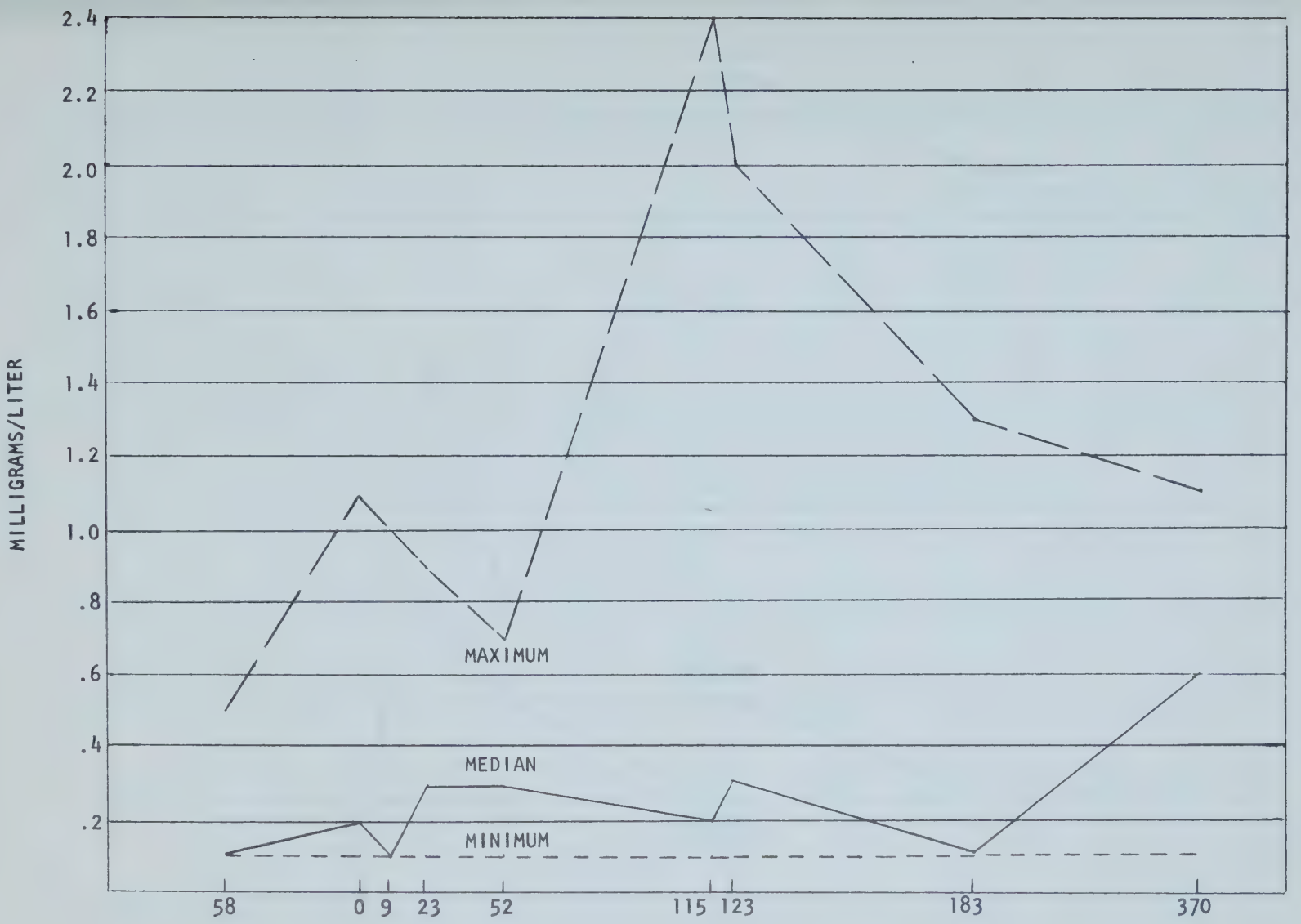
BIOCHEMICAL OXYGEN DEMAND

1971-72 RED DEER RIVER SURVEY



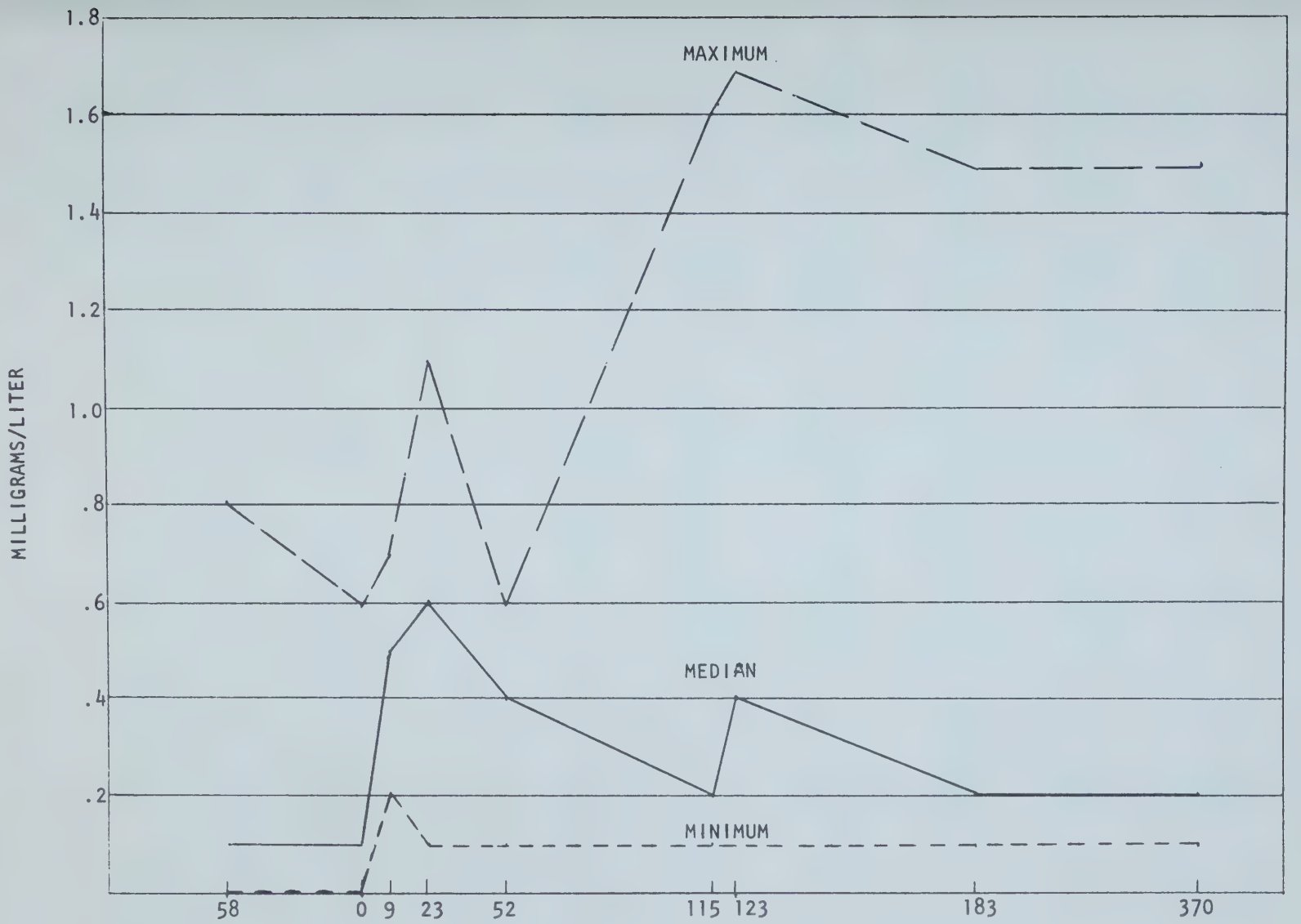
AMMONIA-NITROGEN

1971-72 RED DEER RIVER SURVEY



NITRATE AND NITRITE NITROGEN

1971-72 RED DEER RIVER SURVEY



PHOSPHATES

1971-72 RED DEER RIVER SURVEY

APPENDIX B

STATION 00AT05CB2020 LATITUDE 51D 56M 35S LONGITUDE 114D 25M 55S

RED DEER RIVER WEST OF BOWDEN

SAMPLE DATE	TIME MST	06531L PHENOLIC MATERIAL	10471L RESIDUE TOTAL	10521L RESIDUE VOLATILE TOTAL	06521L OIL & GREASE	36001L COLIFORM TOTAL	36011L COLIFORM FECAL	36900L STANDARD PLATE COUNT BACTERIAL DENSITY
D M Y	H M	MG/L	MG/L	MG/L	C & G MG/L	MPN NO/100ML	MPN NO/100ML	NO/ML
26 8 71	09 00	0.002	150.		0.8	2	0	17000
16 11 71	10 00	0.004	174.		1.4	350	14	500
30 11 71	10 30	0.002	234.		0.4	240	0	550
5 1 72	09 00	0.004	304.		2.3	40	17	1600
15 2 72	08 30	0.002	320.			430	17	8500
22 3 72	09 30	0.028	230.			350	24	4000

SAMPLE DATE	TIME MST	10605L HARDNESS TOTAL	20101L CALCIUM DISSOLVED	10401L RESIDUE NONFILTER.	16302L SULPHATE DISSOLVED	11101L SODIUM DISSOLVED	08101L OXYGEN DISSOLVED	08202L OXYGEN BIOCHEMICAL DEMAND	02001L ODOUR THRESHOLD
D M Y	H M	CACO3 MG/L	CA MG/L	MG/L	SO4 MG/L	NA MG/L	O2 MG/L	O2 MG/L	ODOUR NUMBER T.O.N
26 8 71	09 00	175.			18.			0.8	1
16 11 71	10 00					4.	13.4	0.5	2
30 11 71	10 30				65.	7.	12.7	0.7	4
5 1 72	09 00	210.	37.		65.	4.	11.1	0.8	1
15 2 72	08 30	240.	34.		50.		12.1	0.3	2
22 3 72	09 30	185.	49.		35.	5.	11.8	3.6	

SAMPLE DATE	TIME MST	07106L NITROGEN DISS.NITRATE & NITRITE N	07551L NITROGEN DISSOLVED AMMONIA N	15406L PHOSPHOROUS TOTAL PHOSPHATE P	19101L POTASSIUM DISSOLVED	02041L SPECIFIC CONDUCTANCE	10151L ALKALINITY PHENOL	10101L ALKALINITY TOTAL	10701L SURFACTANTS
D M Y	H M	N MG/L	N MG/L	P MG/L	K MG/L	UMHO/CM	CACO3 MG/L	CACO3 MG/L	MBAS MG/L
26 8 71	09 00	0.1	0.1	0.1			5.	132	
16 11 71	10 00	0.5	0.1	0.8	0.6			155	
30 11 71	10 30	0.1	0.1	0.0	0.8			200	
5 1 72	09 00	0.1	0.1	0.1	1.0			175	
15 2 72	08 30	0.1	L.1	L.1		390		120	
22 3 72	09 30	0.4	0.4	0.8	5.0	300		140	

SAMPLE DATE	TIME MST	02073L TURBIDITY TOTAL	02061F TEMPERATURE	10301L PH	17201L CHLORIDE DISSOLVED	09105L FLUORIDE DISSOLVED	26002L IRON TOTAL FE+2 + FE+3	12103L MAGNESIUM DISSOLVED
D M Y	H M	TURBIDITY UNITS	DEG.C.	PH UNITS	CL MG/L	F MG/L	FE MG/L	MG MG/L
26 8 71	09 00	1.		8.5	32.			
16 11 71	10 00	1.	0	8.2				
30 11 71	10 30	1.	0	8.2	2.			
5 1 72	09 00	1.	0	8.1			L.1	29.
15 2 72	08 30	1.	0	7.9	32.	0.15	L.1	37.
22 3 72	09 30	1.	0	8.1	2.	0.15	0.2	15.

SAMPLE DATE	TIME MST	33003L ARSENIC TOTAL	48CC4L CADMIUM TOTAL	24CC4L CHROMIUM TOTAL	27004L COBALT TOTAL	29008L COPPER TOTAL	82005L LEAD TOTAL	25006L MANGANESE TOTAL	80002L MERCURY TOTAL
D M Y	H M	AS MG/L	CD MG/L	CR MG/L	CO MG/L	CU MG/L	PB MG/L	MN MG/L	HG MG/L
30 11 71	10 30	0.002	0.001	0.002	0.007	0.004	0.02	0.00	0.0065
5 1 72	09 00		0.001	0.001	0.005	0.004	0.02	0.00	L.0005
15 2 72	08 30		L.001	0.021		0.003	0.01	0.00	L.0005
22 3 72	09 30		L.001	0.003	0.004	0.005	0.01	0.02	L.0005

SAMPLE DATE	TIME MST	28004L NICKEL TOTAL	34003L SELENIUM TOTAL	30006L ZINC TOTAL
D M Y	H M	NI MG/L	SE MG/L	ZN MG/L
30 11 71	10 30	0.005	L.01	0.011
5 1 72	09 00	0.006	0.01	0.001
15 2 72	08 30	0.012	L.01	0.012
22 3 72	09 30	0.004	0.01	0.187

WATER QUALITY DATA

STATION 00AT05CC207C LATITUDE 52D 16M 35S LONGITUDE 113D 48M 45S

RED DEER RIVER ABOVE RED DEER

SAMPLE DATE D M Y	SAMPLE TIME MST H M	06531L PHENOLIC MATERIAL MG/L	10471L RESIDUE TOTAL MG/L	10521L RESIDUE VOLATILE TOTAL MG/L	06521L OIL & GREASE C & G MG/L	36001L COLIFORM TOTAL MPN NO/100ML	36011L COLIFORM FECAL MPN NO/100ML	36900L STANDARD PLATE COUNT BACTERIAL DENSITY NO/ML	97161F FLOW AVERAGE (DAILY) PROVISIONAL CU.FT/SEC
26 8 71	09 30	.003	194.			11	0	350000	1040
16 11 71	11 45	0.002	344.		1.2	180	5	10	548
30 11 71	12 00	0.001	362.		0.4	2	0	1100	268
5 1 72	11 00	0.001	336.		1.3	140	0	500000	180
15 2 72	12 00	L.001	345.			920	5	10700	220
21 3 72	10 30		230.			240	0	51500	1000

SAMPLE DATE D M Y	SAMPLE TIME MST H M	10605L HARDNESS TOTAL CACO3 MG/L	20101L CALCIUM DISSOLVED CA MG/L	10401L RESIDUE NONFILTER. MG/L	16302L SULPHATE DISSOLVED SO4 MG/L	11101L SODIUM DISSOLVED NA MG/L	08101L OXYGEN DISSOLVED O2 MG/L	08202L OXYGEN BIOCHEMICAL DEMAND 02 MG/L	02001L ODOUR THRESHOLD ODOUR NUMBER T.O.N
26 8 71	09 30	190.			26.			0.6	2
16 11 71	11 45	215.		22.	40.	7.	13.2	2.1	2
30 11 71	12 00				55.		12.8	1.2	4
5 1 72	11 00	215.	34.		65.	7.	9.0	0.7	1
15 2 72	12 00	210.	32.		35.		10.0	2.4	4
21 3 72	10 30	175.	41.		30.	6.	11.0	7.0	2

SAMPLE DATE D M Y	SAMPLE TIME MST H M	07106L NITROGEN DISS.NITRATE & NITRITE N MG/L	07551L NITROGEN DISSOLVED AMMONIA N MG/L	15406L PHOSPHORUS TOTAL PHOSPHATE P MG/L	19101L POTASSIUM DISSOLVED K MG/L	02041L SPECIFIC CONDUCTANCE UMHO/CM	10151L ALKALINITY PHENOL CACO3 MG/L	10101L ALKALINITY TOTAL CACO3 MG/L	10701L SURFACTANTS MBAS MG/L
26 8 71	09 30	0.1	C.2	0.0			6.0	143	
16 11 71	11 45	0.3	0.1	0.3	1.0	420		190	
30 11 71	12 00	0.1	0.1	0.1	1.4		3.	240	
5 1 72	11 00	0.1	C.1	L.1	1.0			210	
15 2 72	12 00	0.2	L.1	L.1		430		195	0.1
21 3 72	10 30	1.1	1.4	0.6		255		120	0.25

SAMPLE DATE D M Y	SAMPLE TIME MST H M	02073L TURBIDITY TOTAL TURBIDITY UNITS	02061F TEMPERATURE DEG.C.	10301L PH PH UNITS	17201L CHLORIDE DISSOLVED CL MG/L	09105L FLUORIDE DISSOLVED F MG/L	26002L IRON TOTAL FE+2 + FE+3 FE MG/L	12103L MAGNESIUM DISSOLVED MG MG/L
26 8 71	09 30	1.		8.6	3.			
16 11 71	11 45	15.	0	8.3				
30 11 71	12 00	9.	0	8.4	3.	0.10		
5 1 72	11 00	2.	0	7.9	1.	0.17	L.1	32.
15 2 72	12 00	1.	0	7.9	2.	0.15	L.1	32.
21 3 72	10 30	2.	0	7.7	9.	0.10	0.1	17.

SAMPLE DATE D M Y	SAMPLE TIME MST H M	33003L ARSENIC TOTAL AS MG/L	48004L CADMIUM TOTAL CD MG/L	24004L CHROMIUM TOTAL CR MG/L	27004L COBALT TOTAL CO MG/L	29008L COPPER TOTAL CU MG/L	82005L LEAD TOTAL PB MG/L	25006L MANGANESE TOTAL MN MG/L	80002L MERCURY TOTAL HG MG/L
30 11 71	12 00	0.002	0.CC3	0.002	0.005	0.025	0.13	0.02	0.0050
5 1 72	11 00		0.015	0.025	0.007	0.047	1.78	0.03	L.0005
15 2 72	12 00		0.CC2	0.002	0.005	0.018	0.02	0.01	0.0005
21 3 72	10 30		L.CC1	0.004	0.003	0.005	0.01	0.04	0.0015

SAMPLE DATE D M Y	SAMPLE TIME MST H M	28004L NICKEL TOTAL NI MG/L	34003L SELENIUM TOTAL SE MG/L	30006L ZINC TOTAL ZN MG/L
30 11 71	12 00	0.007	L.C1	
5 1 72	11 00	0.025	C.C1	0.008
15 2 72	12 00	0.012	L.C1	0.086
21 3 72	10 30	0.010	0.C2	0.082

WATER QUALITY DATA

STATION 00AT05CC2075 LATITUDE 52D 21M 13S LONGITUDE 113D 45M 15S

RED DEER RIVER AT BURNAK

SAMPLE DATE TIME MST D M Y H M	06531L PHENOLIC MATERIAL MG/L	10471L RESIDUE TOTAL MG/L	10521L RESIDUE VOLATILE TOTAL MG/L	06521L OIL & GREASE C & G MG/L	36001L COLIFORM TOTAL MPN NO/100ML	36011L COLIFORM FECAL MPN NO/100ML	36900L STANDARD PLATE COUNT BACTERIAL DENSITY NO/ML
26 8 71 10 30	.002	164.		0.1	23	0	170000
16 11 71 12 30	0.002	248.		1.5	79	2	2100
30 11 71 13 30	0.001	312.		0.8	170	0	450

SAMPLE DATE TIME MST D M Y H M	10605L HARDNESS TOTAL CACO3 MG/L	20101L CALCIUM DISSOLVED CA MG/L	10401L RESIDUE NONFILTER. MG/L	16302L SULPHATE DISSOLVED SO4 MG/L	11101L SODIUM DISSOLVED NA MG/L	08101L OXYGEN DISSOLVED O2 MG/L	08202L OXYGEN BIOCHEMICAL DEMAND C2 MG/L	02001L ODOUR THRESHOLD ODOUR NUMBER T.O.N
26 8 71 10 30	150.			26.			1.6	1
16 11 71 12 30					11.	16.6	3.2	2
30 11 71 13 30					11.	14.2	1.6	4

SAMPLE DATE TIME MST D M Y H M	07106L NITROGEN DISS.NITRATE & NITRITE N MG/L	07551L NITROGEN DISSOLVED AMMONIA N MG/L	15406L PHOSPHOROUS TOTAL PHOSPHATE P MG/L	19101L POTASSIUM DISSOLVED K MG/L	02041L SPECIFIC CONDUCTANCE UMHO/CM	10151L ALKALINITY PHENOL CACO3 MG/L	10101L ALKALINITY TOTAL CACO3 MG/L	10701L SURFACTANTS MBAS MG/L
26 8 71 10 30	0.1	0.2	0.2			6.0	133	
16 11 71 12 30	0.1	0.5	0.5	1.1		8.0	185	
30 11 71 13 30	0.1	0.9	0.7	1.7		6.0	230	

SAMPLE DATE TIME MST D M Y H M	02073L TURBIDITY TOTAL TURBIDITY UNITS	02061F TEMPERATURE DEG.C.	10301L PH PH UNITS	17201L CHLORIDE DISSOLVED CL MG/L	09105L FLUORIDE DISSOLVED F MG/L	26002L IRON TOTAL FE+2 + FE+3 FE MG/L	12103L MAGNESIUM DISSOLVED MG MG/L
26 8 71 10 30	1.		8.9	4.			
16 11 71 12 30	1.	0	8.5				
30 11 71 13 30	1.	0	8.5	6.			

SAMPLE DATE TIME MST D M Y H M	33003L ARSENIC TOTAL AS MG/L	48004L CADMIUM TOTAL CC MG/L	24004L CHROMIUM TOTAL CR MG/L	27004L COBALT TOTAL CO MG/L	29008L COPPER TOTAL CU MG/L	82005L LEAD TOTAL PB MG/L	25006L MANGANESE TOTAL MN MG/L	80002L MERCURY TOTAL HG MG/L
30 11 71 13 30	0.004	0.002	0.002	0.005	0.003	0.02	0.01	0.0050

SAMPLE DATE TIME MST D M Y H M	28004L NICKEL TOTAL NI MG/L	34003L SELENIUM TOTAL SE MG/L	30006L ZINC TOTAL ZN MG/L
30 11 71 13 30	0.007	L.01	0.006

WATER QUALITY DATA

STATION COAT05CD2090 LATITUDE 52D 16M 0S LONGITUDE 113D 35M 5S

RED DEER RIVER BELOW RED DEER

SAMPLE DATE TIME MST D M Y H M	06531L PHENOLIC MATERIAL MG/L	10471L RESIDUE TOTAL MG/L	10521L RESIDUE VOLATILE TOTAL MG/L	06521L OIL & GREASE C & G MG/L	36001L COLIFORM TOTAL MPN NO/100ML	36011L COLIFORM FECAL MPN NO/100ML	36900L STANDARD PLATE COUNT BACTERIAL DENSITY NO/ML
26 8 71 11 00	0.001	156.		1.8			
16 11 71 14 30	0.003	218.		1.7	8	0	60
30 11 71 14 45	0.002	302.		1.7	49	0	800
5 1 72 12 30	0.004	348.		1.2	170	24	220
15 2 72 13 00	0.001	520.			13	0	60
21 3 72 12 00	0.005	265.			920	39	14000

SAMPLE DATE TIME MST D M Y H M	10605L HARDNESS TOTAL CACO3 MG/L	20101L CALCIUM DISSOLVED CA MG/L	10401L RESIDUE NONFILTER. MG/L	16302L SULPHATE DISSOLVED SO4 MG/L	11101L SODIUM DISSOLVED NA MG/L	08101L OXYGEN DISSOLVED O2 MG/L	08202L OXYGEN BIOCHEMICAL DEMAND O2 MG/L	02001L CDOUR THRESHOLD ODOUR NUMBER T.O.N
26 8 71 11 00	145.			16.			1.9	1
16 11 71 14 30					10.	14.6	1.1	2
30 11 71 14 45					13.	14.1	1.3	4
5 1 72 12 30	200.	73.		60.	11.	4.3	0.7	4
15 2 72 13 00	290.	45.		65.		9.6	0.5	4
21 3 72 12 00	155.			25.	7.	11.2	4.8	2

SAMPLE DATE TIME MST D M Y H M	07106L NITROGEN DISS.NITRATE & NITRITE N MG/L	07551L NITROGEN DISSOLVED AMMONIA N MG/L	15406L PHOSPHORUS TOTAL PHOSPHATE P MG/L	19101L POTASSIUM DISSOLVED K MG/L	02041L SPECIFIC CONDUCTANCE UMHO/CM	10151L ALKALINITY PHENOL CACO3 MG/L	10101L ALKALINITY TOTAL CACO3 MG/L	10701L SURFACTANTS MBAS MG/L
26 8 71 11 00	0.1	0.2	0.1			6.	104	
16 11 71 14 30	0.1	0.2	0.6	1.1		3.	195	
30 11 71 14 45	0.1	0.5	0.5	1.7		12.	245	0.2
5 1 72 12 30	0.3	0.8	0.5	1.			230	.15
15 2 72 13 00	0.5	1.2	0.7		650		310	0.1
21 3 72 12 00	0.9	1.7	1.1	9.0			95	

SAMPLE DATE TIME MST D M Y H M	02073L TURBIDITY TOTAL TURBIDITY UNITS	02061F TEMPERATURE DEG.C.	10301L PH PH UNITS	17201L CHLORIDE DISSOLVED CL MG/L	09105L FLUORIDE DISSOLVED F MG/L	26002L IRON TOTAL FE+2 + FE+3 FE MG/L	12103L MAGNESIUM DISSOLVED MG MG/L
26 8 71 11 00	1.		9.1	3.			
16 11 71 14 30	1.	0	8.4				
30 11 71 14 45	1.	0	8.5	5.			
5 1 72 12 30	1.	0	7.8	2.		L.1	4.
15 2 72 13 00	1.	0	8.0	9.			43.
21 3 72 12 00	4.	0	7.4	10.0	0.10	0.5	15.

SAMPLE DATE TIME MST D M Y H M	33003L ARSENIC TOTAL AS MG/L	48CC4L CADMIUM TOTAL CD MG/L	24004L CHROMIUM TOTAL CR MG/L	27004L COBALT TOTAL CO MG/L	29008L COPPER TOTAL CU MG/L	82005L LEAD TOTAL PB MG/L	25006L MANGANESE TOTAL MN MG/L	80002L MERCURY TOTAL HG MG/L
30 11 71 14 45	0.004	0.002	0.002	0.005	0.013	0.02	0.01	0.0045
5 1 72 12 30		0.001	0.002	0.005	0.005	0.03	0.01	L.0005
15 2 72 13 00		L.001	0.001	0.005	0.002	0.01	0.02	L.0005
21 3 72 12 00		L.001	0.002	0.001	0.011	0.01	0.07	L.0005

SAMPLE DATE TIME MST D M Y H M	28004L NICKEL TOTAL NI MG/L	34003L SELENIUM TOTAL SE MG/L	30006L ZINC TOTAL ZN MG/L
30 11 71 14 45	0.007	L.01	0.008
5 1 72 12 30	0.009	L.01	0.001
15 2 72 13 00	0.008	L.01	0.068
21 3 72 12 00	0.010	L.01	0.052

WATER QUALITY DATA

STATION 00AT05CD2095 LATITUDE 52D 15M LONGITUDE 113D 30M

RED DEER RIVER 21 MILES EAST OF RED DEER

SAMPLE DATE D M Y	SAMPLE TIME MST H M	06531L PHENOLIC MATERIAL MG/L	10471L RESIDUE TOTAL MG/L	10521L RESIDUE VOLATILE TOTAL MG/L	06521L OIL & GREASE O & G MG/L	36001L COLIFORM TOTAL MPN NO/100ML	36011L COLIFORM FECAL MPN NO/100ML	36900L STANDARD PLATE COUNT BACTERIAL DENSITY NO/ML
17 12 71	16 30		408.					

SAMPLE DATE D M Y	SAMPLE TIME MST H M	10605L HARDNESS TOTAL CACO3 MG/L	20101L CALCIUM DISSOLVED CA MG/L	10401L RESIDUE NONFILTER. MG/L	16302L SULPHATE DISSOLVED SO4 MG/L	11101L SODIUM DISSOLVED NA MG/L	08101L OXYGEN DISSOLVED O2 MG/L	00202L OXYGEN BIOCHEMICAL DEMAND O2 MG/L	02001L CODUR THRESHOLD ODOUR NUMBER T.O.N
17 12 71	16 30	355.			55.	18.			16

SAMPLE DATE D M Y	SAMPLE TIME MST H M	07106L NITROGEN DISS.NITRATE & NITRITE N MG/L	07551L NITROGEN DISSOLVED AMMONIA N MG/L	15406L PHOSPHOROUS TOTAL PHOSPHATE P MG/L	19101L POTASSIUM DISSOLVED K MG/L	02041L SPECIFIC CONDUCTANCE UMHO/CM	10151L ALKALINITY PHENOL CACO3 MG/L	10101L ALKALINITY TOTAL CACO3 MG/L
17 12 71	16 30	0.5	3.4	1.3	2.6			195

SAMPLE DATE D M Y	SAMPLE TIME MST H M	02073L TURBIDITY TOTAL TURBIDITY UNITS	02061F TEMPERATURE DEG.C.	10301L PH PH UNITS	17201L CHLORIDE DISSOLVED CL MG/L	09105L FLUORIDE DISSOLVED F MG/L	26002L IRON TOTAL FE+2 + FE+3 FE MG/L	12103L MAGNESIUM DISSOLVED MG MG/L
17 12 71	16 30	1.	0	7.4	8.			

WATER QUALITY DATA

STATION C0AT05C02100 LATITUDE 52D 19M 5S LONGITUDE 113D 5M 2S

RED DEER RIVER ABOVE GULF NEVIS GAS PLANT

SAMPLE DATE D M Y	TIME MST H M	06531L PHENOLIC MATERIAL MG/L	10471L RESIDUE TOTAL MG/L	10521L RESIDUE VOLATILE TOTAL MG/L	06521L OIL & GREASE O & G MG/L	36001L COLIFORM TOTAL MPN NO/100ML	36011L COLIFORM FECAL MPN NO/100ML	36900L STANDARD PLATE COUNT BACTERIAL DENSITY NO/ML
26 8 71	11 30	0.001	168.		0.1	0	0	36000
16 11 71	15 30	0.000	248.		2.0	0	0	20
30 11 71	16 00	0.001	322.		2.6	0	0	1
5 1 72	14 00	0.005	368.		1.0	8	2	300
15 2 72	16 00	L.001	380.			5	2	310
21 3 72	16 00	0.011	380.			33	7	3500

SAMPLE DATE D M Y	TIME MST H M	10605L HARDNESS TOTAL CACO3 MG/L	20101L CALCIUM DISSOLVED CA MG/L	10401L RESIDUE NONFILTER. MG/L	16302L SULPHATE DISSOLVED SO4 MG/L	11101L SODIUM DISSOLVED NA MG/L	08101L OXYGEN DISSOLVED O2 MG/L	08202L OXYGEN BIOCHEMICAL DEMAND O2 MG/L	02001L ODOUR THRESHOLD ODOUR NUMBER T.O.N
26 8 71	11 30	150.			24.			1.7	1
16 11 71	15 30					12.	14.5	1.0	2
30 11 71	16 00					16.	13.1	0.8	4
5 1 72	14 00	285.	46.		60.	15.	1.9	1.0	4
15 2 72	16 00	250.	41.		60.			0.9	4
21 3 72	16 00	250.	62.		45.	12.	11.6	3.9	2

SAMPLE DATE D M Y	TIME MST H M	07106L NITROGEN DISS.NITRATE & NITRITE N MG/L	07551L NITROGEN DISSOLVED AMMONIA N MG/L	15406L PHOSPHORUS TOTAL PHOSPHATE P MG/L	19101L POTASSIUM DISSOLVED K MG/L	02041L SPECIFIC CONDUCTANCE UMHO/CM	10151L ALKALINITY PHENOL CACO3 MG/L	10101L ALKALINITY TOTAL CACO3 MG/L	10701L SURFACTANTS MBAS MG/L
26 8 71	11 30	0.1	0.2	0.1			5.0	113	
16 11 71	15 30	0.2	0.2	0.1	1.1		3.	190	
30 11 71	16 00	0.2	0.2	0.3	1.8		11.	255	
5 1 72	14 00	0.3	0.8	0.5	2.0			240	
15 2 72	16 00	0.5	0.7	0.4		520		240	
21 3 72	16 00	0.7	1.2	0.6	2.6			180	

SAMPLE DATE D M Y	TIME MST H M	02073L TURBIDITY TOTAL TURBIDITY UNITS	02061F TEMPERATURE DEG.C.	10301L PH PH UNITS	17201L CHLORIDE DISSOLVED CL MG/L	09105L FLUORIDE DISSOLVED F MG/L	26002L IRON TOTAL FE+2 + FE+3 FE MG/L	12103L MAGNESIUM DISSOLVED MG MG/L
26 8 71	11 30	1.		8.9	4.0			
16 11 71	15 30	1.	0	8.4				
30 11 71	16 00	1.	0	8.4	7.0			
5 1 72	14 00	1.	0	7.8	2.0		L.1	41.
15 2 72	16 00	1.	0	7.6	8.0	0.15	L.1	35.
21 3 72	16 00	7.	0	7.8	5.0	0.15	0.2	23.

SAMPLE DATE D M Y	TIME MST H M	33002L ARSENIC TOTAL AS MG/L	48004L CADMIUM TOTAL CD MG/L	24004L CHROMIUM TOTAL CR MG/L	27004L COBALT TOTAL CO MG/L	29008L COPPER TOTAL CU MG/L	82005L LEAD TOTAL PB MG/L	25006L MANGANESE TOTAL MN MG/L	80002L MERCURY TOTAL HG MG/L
30 11 71	16 00	0.004	0.002	0.002	0.005	0.002	0.02	0.01	0.0065
5 1 72	14 00		0.001	0.002	0.005	0.006	0.09	0.03	L.0005
15 2 72	16 00		L.001	0.001	0.005	0.005	0.01	0.03	L.0005
21 3 72	16 00		0.001	0.009	0.006	0.011	0.03	0.10	0.0017

SAMPLE DATE D M Y	TIME MST H M	28004L NICKEL TOTAL NI MG/L	34003L SELENIUM TOTAL SE MG/L	30006L ZINC TOTAL ZN MG/L
30 11 71	16 00	0.007	L.01	0.004
5 1 72	14 00	0.008	0.01	0.004
15 2 72	16 00	0.006	L.01	0.058
21 3 72	16 00	0.010	0.01	0.098

WATER QUALITY DATA

STATION 00AT05CE2120 LATITUDE 51D 28M 8S LONGITUDE 112D 42M 30S

RED DEER RIVER ABOVE CRUMFELLER

SAMPLE DATE TIME MST	06531L PHENOLIC MATERIAL	10471L RESIDUE TOTAL	10521L RESIDUE VOLATILE TOTAL	06521L OIL & GREASE	36001L COLIFORM TOTAL	36011L COLIFORM FECAL	36900L STANDARD PLATE COUNT BACTERIAL DENSITY	97161F FLOW AVERAGE (DAILY) PROVISIONAL
D M Y H M	MG/L	MG/L	MG/L	C & G MG/L	MPN NO/100ML	MPN NO/100ML	NO/ML	CU.FT/SEC
31 8 71 12 00	0.001	166.		1.3	2	0	13000	1050
17 11 71 09 00	0.002	264.		1.5	0	0	10000	511
30 11 71 07 00	0.000	304.		2.6	0	0	200	275
5 1 72 07 35	0.005	358.		10.7	0	0	200	155
18 2 72 12 00	0.003	370.			0	0	450	370
22 3 72 09 00	0.007	SEC.			10	4	80000	650

SAMPLE DATE TIME MST	10605L HARDNESS TOTAL	20101L CALCIUM DISSOLVED	10401L RESIDUE NONFILTER.	16302L SULPHATE DISSOLVED	11101L SODIUM DISSOLVED	08101L OXYGEN DISSOLVED	08202L OXYGEN BIOCHEMICAL DEMAND	02001L ODOUR THRESHOLD ODOUR NUMBER
D M Y H M	CACO3 MG/L	CA MG/L	MG/L	SO4 MG/L	NA MG/L	O2 MG/L	C2 MG/L	T.O.N
31 8 71 12 00	155.					9.4	0.9	1
17 11 71 09 00	220.				17.	15.1	0.4	2
30 11 71 07 00	250.				16.	13.9	1.0	8
5 1 72 07 35	210.	50.		70.	11.	3.4	1.3	4
18 2 72 12 00	240.	45.		75.		2.2		8
22 3 72 09 00	180.		685.	80.	32.	10.0	4.9	1

SAMPLE DATE TIME MST	07106L NITROGEN DISS.NITRATE & NITRITE N	07551L NITROGEN DISSOLVED AMMONIA N	15406L PHOSPHOROUS TOTAL PHOSPHATE P	19101L POTASSIUM DISSOLVED K	02041L SPECIFIC CONDUCTANCE	10151L ALKALINITY PHENOL	10101L ALKALINITY TOTAL	10701L SURFACTANTS ALKYL ARYL SULPHONATE
D M Y H M	MG/L	MG/L	MG/L	MG/L	UMHO/CM	CACO3 MG/L	CACO3 MG/L	MBAS MG/L
31 8 71 12 00	0.1	0.2	0.2			5.0	114	
17 11 71 09 00	0.2	0.1	0.1	1.4				
30 11 71 07 00	0.1	0.1	0.1	1.8		2.0	240	
5 1 72 07 35	0.2	0.5	0.2	2.0			315	
18 2 72 12 00	0.5	0.8	0.3		510		250	
22 3 72 09 00	2.4	1.2	1.6	4.4			135	

SAMPLE DATE TIME MST	02073L TURBIDITY TOTAL	02061F TEMPERATURE	10301L PH	17201L CHLORIDE DISSOLVED	09105L FLUORIDE DISSOLVED	26002L IRON TOTAL FE+2 + FE+3	12103L MAGNESIUM DISSOLVED
D M Y H M	TURBIDITY UNITS	DEG.C.	PH UNITS	CL MG/L	F MG/L	FE MG/L	MG MG/L
31 8 71 12 00	4.		8.6	5.			
17 11 71 09 00	2.	0	8.2				
30 11 71 07 00	7.	0	8.4	2.			
5 1 72 07 35	1.	0	7.9			L.1	30.
15 2 72 09 45						0.3	
18 2 72 12 00	1.		7.5	10.		L.1	31.
22 3 72 09 00			7.7				18.

SAMPLE DATE TIME MST	33003L ARSENIC TOTAL	48004L CADMIUM TOTAL	24004L CHROMIUM TOTAL	27004L COBALT TOTAL	29008L COPPER TOTAL	82005L LEAD TOTAL	25006L MANGANESE TOTAL	80002L MERCURY TOTAL
D M Y H M	AS MG/L	CD MG/L	CR MG/L	CO MG/L	CU MG/L	PB MG/L	MN MG/L	HG MG/L
30 11 71 07 00	0.002	0.001	0.002	0.005	0.036	0.03	0.02	0.0065
5 1 72 07 35		0.001	0.005	0.007	0.041	0.32	0.02	L.0005
22 3 72 09 00		0.002	0.032	0.014	0.050	0.03	0.28	L.0005

SAMPLE DATE TIME MST	28004L NICKEL TOTAL	34003L SELENIUM TOTAL	30006L ZINC TOTAL
D M Y H M	NI MG/L	SE MG/L	ZN MG/L
30 11 71 07 00	0.007	L.01	0.008
5 1 72 07 35	0.015	0.01	0.014
22 3 72 09 00	0.033	0.02	0.162

WATER QUALITY DATA

STATION 00AT05CE2130 LATITUDE 51D 20M 45S LONGITUDE 112D 28M 50S

RED DEER RIVER BELOW CRUMHELLER

SAMPLE DATE	SAMPLE TIME	06531L PHENOLIC MATERIAL	10471L RESIDUE TOTAL	10521L RESIDUE VOLATILE TOTAL	06521L OIL & GREASE	36001L COLIFORM TOTAL	36011L COLIFORM FECAL	36900L STANDARD PLATE COUNT BACTERIAL DENSITY
	MST				O & G	MPN	MPN	
D M Y	H M	MG/L	MG/L	MG/L	MG/L	NO/100ML	NO/100ML	NO/ML
31 8 71	13 00	0.030	178.		0.9	41	4	25000
17 11 71	10 00	0.000	290.		2.4	15	0	78000
30 11 71	07 30	0.012	338.		3.2			
5 1 72	09 15	0.004	636.		5.2	1800	15	11200
15 2 72	10 45	0.006	355.			430	17	5500
18 2 72	12 30	0.003	330.			45	13	2050
22 3 72	10 00	0.009	1060.			180	32	30000

SAMPLE DATE	SAMPLE TIME	10605L HARDNESS TOTAL	20101L CALCIUM DISSOLVED	10401L RESIDUE NONFILTER.	16302L SULPHATE DISSOLVED	11101L SODIUM DISSOLVED	C8101L OXYGEN DISSOLVED	08202L OXYGEN BIOCHEMICAL DEMAND	02001L ODOUR THRESHOLD
	MST	CACO3	CA		SO4	NA	O2	O2	ODOUR NUMBER
D M Y	H M	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	T.O.N
31 8 71	13 00						9.7	0.8	1
17 11 71	10 00					17.	13.3	2.0	2
30 11 71	07 30					21.	13.5	2.4	4
5 1 72	09 15	225.	58.	25.	80.	23.	2.8	2.8	4
15 2 72	10 45	240.	32.		45.		0.6	1.9	4
18 2 72	12 30	250.	37.		65.		0.9		4
22 3 72	10 00	210.	46.	725.	70.	36.	9.8	4.0	1

SAMPLE DATE	SAMPLE TIME	07106L NITROGEN DISS.NITRATE & NITRITE	C7551L NITROGEN DISSOLVED AMMONIA	15406L PHOSPHORUS TOTAL PHOSPHATE	19101L POTASSIUM DISSOLVED	02041L SPECIFIC CONDUCTANCE	10151L ALKALINITY PHENOL	10101L ALKALINITY TOTAL	10701L SURFACTANTS
	MST	N	N	P	K		CACO3	CACO3	MBAS
D M Y	H M	MG/L	MG/L	MG/L	MG/L	UMHO/CM	MG/L	MG/L	MG/L
31 8 71	13 00	0.1	0.3	0.0			6.	112	
17 11 71	10 00	0.4	0.1	0.2	1.0				
30 11 71	07 30	0.1	0.1	0.1	2.0		5.	239	
5 1 72	09 15	0.3	1.3	0.4	3.0			315	0.001
15 2 72	10 45	0.1	1.0	0.4		500		230	0.01
18 2 72	12 30	0.4	0.9	0.6		510		235	
22 3 72	10 00	2.0	1.1	1.7	5.4			130	

SAMPLE DATE	SAMPLE TIME	02073L TURBIDITY TOTAL	02061F TEMPERATURE	10301L PH	17201L CHLORIDE DISSOLVED	09105L FLUORIDE DISSOLVED	26002L IRON TOTAL FE+2 + FE+3	12103L MAGNESIUM DISSOLVED
	MST	TURBIDITY			CL	F	FE	MG
D M Y	H M	UNITS	DEG.C.	PH UNITS	MG/L	MG/L	MG/L	MG/L
31 8 71	13 00	5.		8.6	7.			
17 11 71	10 00	3.	0	8.2				
30 11 71	07 30	3.	0	8.5	5.			
5 1 72	09 15	22.	0	7.8	5.		L.1	20.
15 2 72	10 45	1.	0	7.4	9.		L.1	41.
18 2 72	12 30	1.		7.7	7.		L.1	38.
22 3 72	10 00			7.6	2.		0.4	23.

SAMPLE DATE	SAMPLE TIME	33003L ARSENIC TOTAL	48C04L CADMIUM TOTAL	24004L CHROMIUM TOTAL	27004L COBALT TOTAL	29008L COPPER TOTAL	82005L LEAD TOTAL	25006L MANGANESE TOTAL	80002L MERCURY TOTAL
	MST	AS	CD	CR	CO	CU	PB	MN	HG
D M Y	H M	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
30 11 71	07 30	0.002	0.002	0.002	0.005	0.011	0.03	0.02	0.0070
5 1 72	09 15		0.001	0.011	0.007	0.006	0.04	0.06	L.0005
15 2 72	10 45		0.001	0.002	0.005	0.002	0.01	0.06	0.0010
22 3 72	10 00		0.001	0.044	0.016	0.050	0.03	0.42	0.0015

SAMPLE DATE	SAMPLE TIME	28004L NICKEL TOTAL	34003L SELENIUM TOTAL	30006L ZINC TOTAL
	MST	NI	SE	ZN
D M Y	H M	MG/L	MG/L	MG/L
30 11 71	07 30	0.008	L.01	0.018
5 1 72	09 15	0.011	0.01	0.018
15 2 72	10 45	0.008	L.01	0.038
22 3 72	10 00	0.051	0.02	0.187

WATER QUALITY DATA

STATION 00AT05CJ2140 LATITUDE 50D 55M 0S LONGITUDE 111D 56M 0S

REC DEER RIVER AT HWY 36

SAMPLE DATE MST D	M	Y	TIME H	M	06531L PHENOLIC MATERIAL MG/L	10471L RESIDUE TOTAL MG/L	10521L RESIDUE VOLATILE TOTAL MG/L	06521L OIL & GREASE C & G MG/L	36001L COLIFORM TOTAL MPN NO/100ML	36011L COLIFORM FECAL MPN NO/100ML	36900L STANDARD PLATE COUNT BACTERIAL DENSITY NO/ML
31	8	71	15	30	0.007	222.		0.9	8	0	1000
17	11	71	11	30	0.000	334.		1.1	6	0	133000
30	11	71	10	30	0.007	366.		2.8	7	4	500
5	1	72	11	10		444.			13	0	100
15	2	72	12	45	C.003	505.			17	4	500
22	3	72	12	30	C.004	815.			13	4	17000

SAMPLE DATE MST D	M	Y	TIME H	M	10605L HARDNESS TOTAL CACO3 MG/L	20101L CALCIUM DISSOLVED CA MG/L	10401L RESIDUE NONFILTER. MG/L	16302L SULPHATE DISSOLVED SO4 MG/L	11101L SODIUM DISSOLVED NA MG/L	C8101L OXYGEN DISSOLVED O2 MG/L	08202L OXYGEN BIOCHEMICAL DEMAND C2 MG/L	02001L ODOUR THRESHOLD ODOUR NUMBER T.O.N
31	8	71	15	30	160.			32.		8.7	1.3	
17	11	71	11	30	240.				24.	14.0	C.7	2
30	11	71	10	30	255.				23.	14.2	1.5	4
5	1	72	11	10	250.	43.		60.	38.	1.1	C.7	4
15	2	72	12	45	220.	33.		35.			1.3	4
22	3	72	12	30	190.	42.	630.	50.	28.	10.9	3.7	2

SAMPLE DATE MST D	M	Y	TIME H	M	C7106L NITROGEN DISS.NITRATE & NITRITE N MG/L	07551L NITROGEN DISSOLVED AMMONIA N MG/L	15406L PHOSPHOROUS TOTAL PHOSPHATE P MG/L	19101L POTASSIUM DISSOLVED K MG/L	02041L SPECIFIC CONDUCTANCE UMHO/CM	10151L ALKALINITY PHENOL CACO3 MG/L	10101L ALKALINITY TOTAL CACO3 MG/L	10701L SURFACTANTS MBAS MG/L
31	8	71	15	30	0.1	C.2	0.1			5.0	126	
17	11	71	11	30	0.4	0.1	0.1	1.1				
30	11	71	10	30	0.1	0.1	1.2	2.0		15.0	245	
5	1	72	11	10	L.1	0.5	0.1	5.0			310	
15	2	72	12	45	L.1	0.7	0.2		680		320	
22	3	72	12	30	1.3	1.5	1.5	3.2			150	

SAMPLE DATE MST D	M	Y	TIME H	M	02073L TURBIDITY TOTAL TURBIDITY UNITS	02061F TEMPERATURE DEG.C.	10301L PH PH UNITS	17201L CHLORIDE DISSOLVED CL MG/L	09105L FLUORIDE DISSOLVED F MG/L	26002L IRON TOTAL FE+2 + FE+3 FE MG/L	12103L MAGNESIUM DISSOLVED MG MG/L
31	8	71	15	30	12.		8.5	6.	0.32		
17	11	71	11	30	11.	0	8.2				
30	11	71	10	30	7.	0	8.4	5.	0.10		
5	1	72	11	10	1.	0	8.1	35.	0.06	L.1	
15	2	72	12	45	1.	0	7.7	26.	0.05	L.1	33.
22	3	72	12	30			7.8	2.	0.20		21.

SAMPLE DATE MST D	M	Y	TIME H	M	33003L ARSENIC TOTAL AS MG/L	48004L CADMIUM TOTAL CD MG/L	24004L CHROMIUM TOTAL CR MG/L	27004L COBALT TOTAL CO MG/L	29008L COPPER TOTAL CU MG/L	82005L LEAD TOTAL PB MG/L	25006L MANGANESE TOTAL MN MG/L	80002L MERCURY TOTAL HG MG/L
30	11	71	10	30	0.005	0.002	0.002	0.005	0.014	0.01	0.02	0.0065
5	1	72	11	10		0.001	0.002	0.007	0.002	0.03	0.05	L.0005
15	2	72	12	45		L.001	0.004	C.004	0.003	0.03	0.10	L.0005
22	3	72	12	30		0.001	0.015	0.010	0.029	0.00	0.15	0.0011

SAMPLE DATE MST D	M	Y	TIME H	M	28004L NICKEL TOTAL NI MG/L	34003L SELENIUM TOTAL SE MG/L	30006L ZINC TOTAL ZN MG/L
30	11	71	10	30	C.012	L.01	0.014
5	1	72	11	10	C.009	0.005	0.004
15	2	72	12	45	0.013	L.01	0.025
22	3	72	12	30	0.027	L.01	0.082

WATER QUALITY DATA

STATION 00AT05CK215C LATITUDE 500 56M 50S LONGITUDE 1100 5M 10S

RED DEER RIVER AT EMPRESS

SAMPLE DATE	TIME MST	06531L PHENOLIC MATERIAL	10471L RESIDUE TOTAL	10521L RESIDUE VOLATILE TOTAL	06521L OIL & GREASE	36001L COLIFORM TOTAL	36011L COLIFORM FECAL	36900L STANDARD PLATE COUNT BACTERIAL	97161F FLOW AVERAGE (DAILY)
D M Y	H M	MG/L	MG/L	MG/L	O & G MG/L	MPN NO/100ML	MPN NO/100ML	DENSITY NO/ML	PROVISIONAL CU.FT/SEC
1 9 71	10 30	0.000	430.		1.0	350	9	4000	1490
17 11 71	17 00	0.000	426.		1.3	0	0	350	564
30 11 71	16 00	0.010	436.		2.6				405
5 1 72	17 20	0.004	556.		0.1	9	2	200	139
15 2 72	18 30	0.005	485.			1600	47	470	178
22 3 72	17 30	0.012	1315.		4.1	79	17	4500	1510

SAMPLE DATE	TIME MST	10605L HARDNESS TOTAL	20101L CALCIUM DISSOLVED	10401L RESIDUE NONFILTER.	16302L SULPHATE DISSOLVED	11101L SODIUM DISSOLVED	08101L OXYGEN DISSOLVED	08202L OXYGEN BIOCHEMICAL DEMAND	02001L ODOUR THRESHOLD
D M Y	H M	CACO3 MG/L	CA MG/L	MG/L	SO4 MG/L	NA MG/L	O2 MG/L	O2 MG/L	ODOUR NUMBER T.O.N
1 9 71	10 30	155.		35.	42.		9.2	1.3	1
17 11 71	17 00	245.			95.	42.	13.5	1.3	2
30 11 71	16 00	270.			95.	33.	13.8	1.1	4
5 1 72	17 20	345.	85.		145.	55.	4.5	0.4	4
15 2 72	18 30	190.	21.		55.		0.4	0.5	4
22 3 72	17 30	165.	37.	1130.	50.	29.	12.4	2.4	2

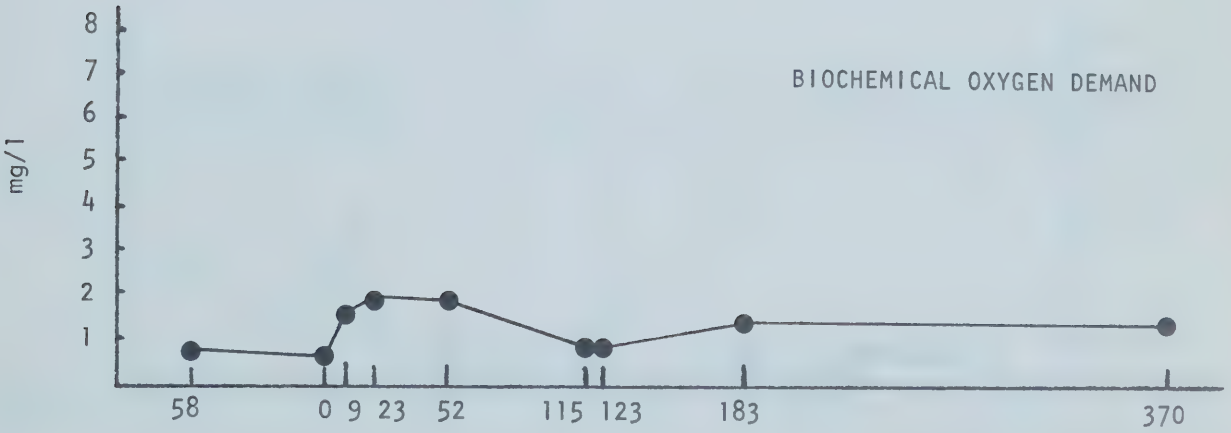
SAMPLE DATE	TIME MST	07106L NITROGEN DISS.NITRATE & NITRITE	07551L NITROGEN DISSOLVED AMMONIA	15406L PHOSPHOROUS TOTAL PHOSPHATE	19101L POTASSIUM DISSOLVED	02041L SPECIFIC CONDUCTANCE	10151L ALKALINITY PHENOL	10101L ALKALINITY TOTAL	10701L SURFACTANTS
D M Y	H M	N MG/L	N MG/L	P MG/L	K MG/L	UMHO/CM	CACO3 MG/L	CACO3 MG/L	MBAS MG/L
1 9 71	10 30	1.1	0.2	0.4			3.0	140	
17 11 71	17 00	0.4	0.1	0.2	2.6			215	
30 11 71	16 00	0.6	0.1	0.1	2.6		1.0	280	0.1
5 1 72	17 20	0.3		0.2	5.0			390	0.08
15 2 72	18 30	L.1	L.1	L.1		640		290	20.1
22 3 72	17 30	0.6	1.2	1.5	2.8			120	0.1

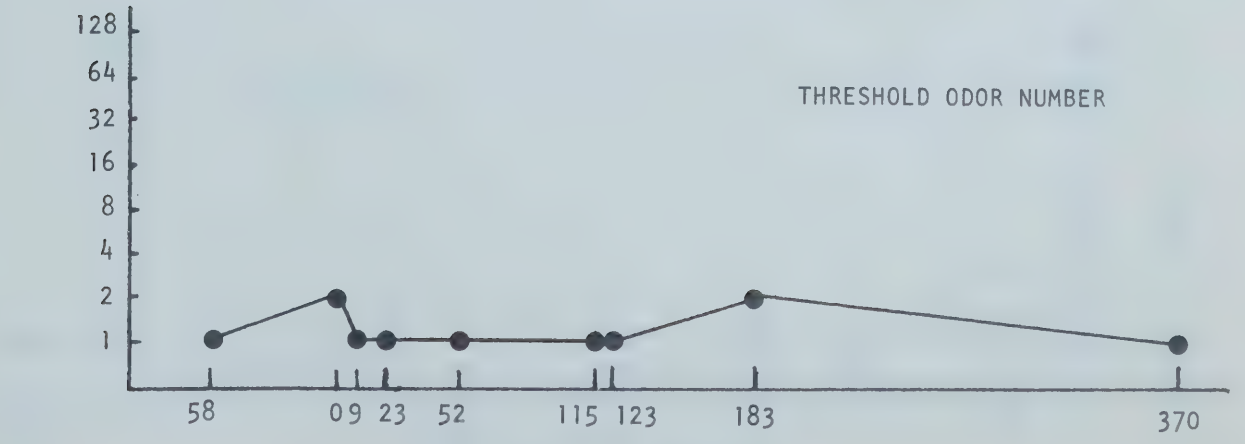
SAMPLE DATE	TIME MST	02073L TURBIDITY TOTAL	02061F TEMPERATURE	10301L PH	17201L CHLORIDE DISSOLVED	09105L FLUORIDE DISSOLVED	26002L IRON TOTAL FE+2 + FE+3	12103L MAGNESIUM DISSOLVED
D M Y	H M	TURBIDITY UNITS	DEG.C.	PH UNITS	CL MG/L	F MG/L	FE MG/L	MG MG/L
1 9 71	10 30			8.6	6.	0.25		
17 11 71	17 00	6.	0	8.2	8.			
30 11 71	16 00	11.	0	8.4	8.	0.15		
5 1 72	17 20	2.	0	8.1	20.		L.1	27.
15 2 72	18 30	1.	0	7.5	13.		L.1	34.
22 3 72	17 30			7.8	4.			17.

SAMPLE DATE	TIME MST	33003L ARSENIC TOTAL	48004L CADMIUM TOTAL	24004L CHROMIUM TOTAL	27004L COBALT TOTAL	29008L COPPER TOTAL	82005L LEAD TOTAL	25006L MANGANESE TOTAL	80002L MERCURY TOTAL
D M Y	H M	AS MG/L	CD MG/L	CR MG/L	CO MG/L	CU MG/L	PB MG/L	MN MG/L	HG MG/L
30 11 71	16 00	0.005	0.007	0.003	0.005	0.052	0.03	0.03	0.007
5 1 72	17 20		0.001	0.005	0.007	0.017	0.03	0.02	L.0005
15 2 72	18 30		0.001	0.004	0.010	0.045	0.00	0.10	0.0005
22 3 72	17 30		0.001	0.039	0.018	0.053	0.04	0.43	0.0009

SAMPLE DATE	TIME MST	28004L NICKEL TOTAL	34003L SELENIUM TOTAL	30006L ZINC TOTAL
D M Y	H M	NI MG/L	SE MG/L	ZN MG/L
30 11 71	16 00	0.010	L.01	0.010
5 1 72	17 20	0.011	0.01	0.007
15 2 72	18 30	0.016	L.01	0.015
22 3 72	17 30	0.065	L.01	0.203

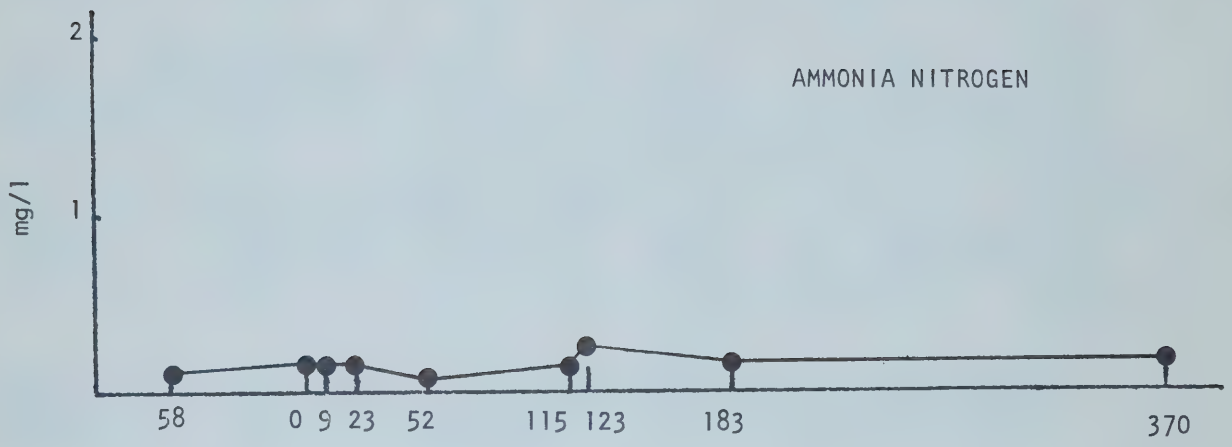
AUGUST 26 - SEPTEMBER 1, 1971

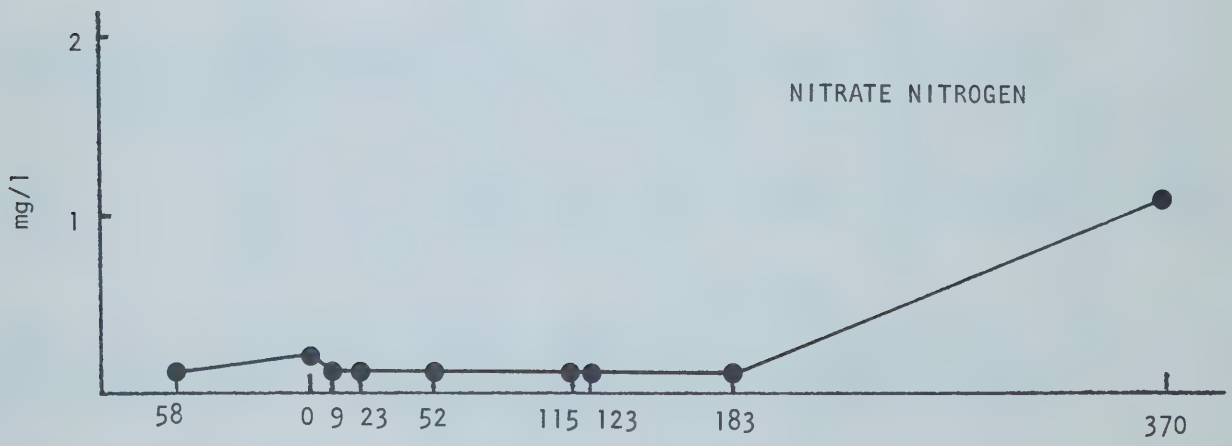


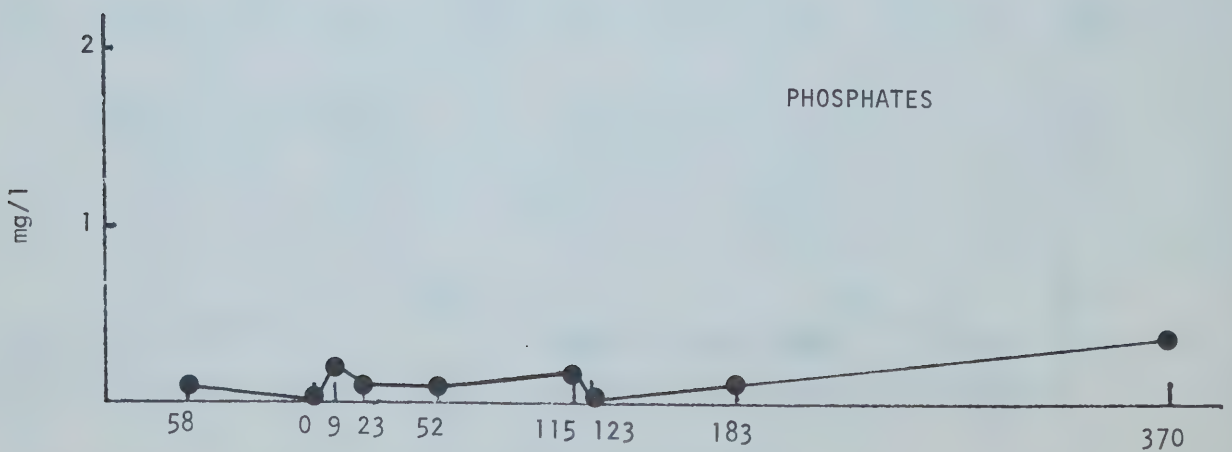


RIVER MILES FROM RED DEER

AUGUST 26 - SEPTEMBER 1, 1971

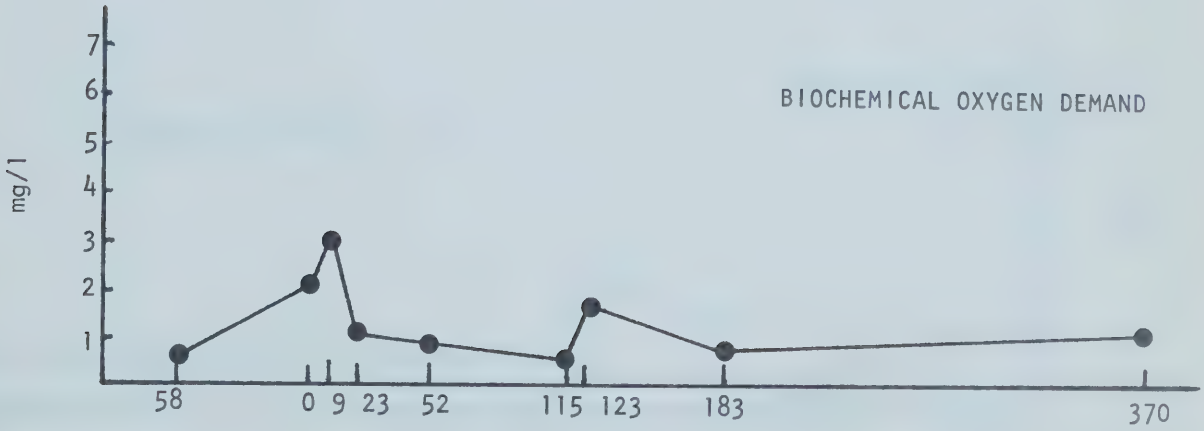


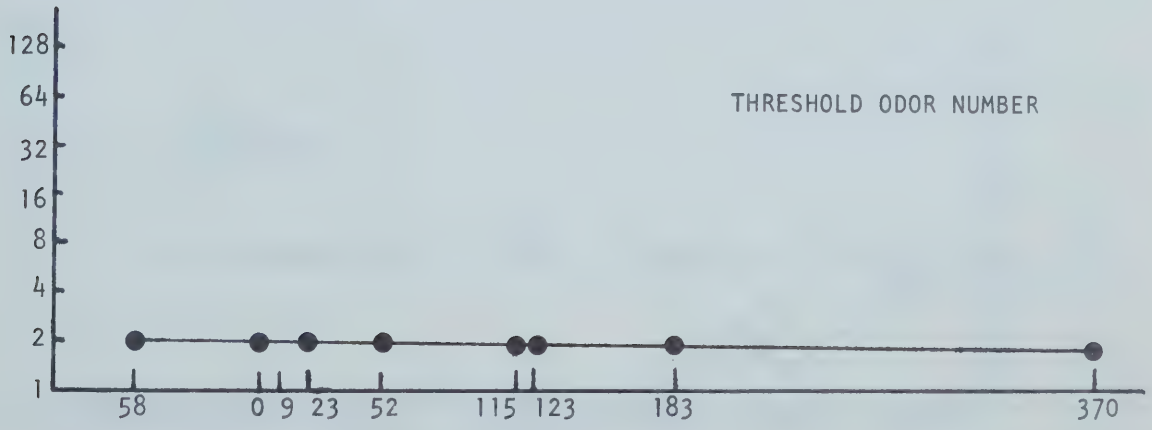




RIVER MILES FROM RED DEER

NOVEMBER 16, 1971





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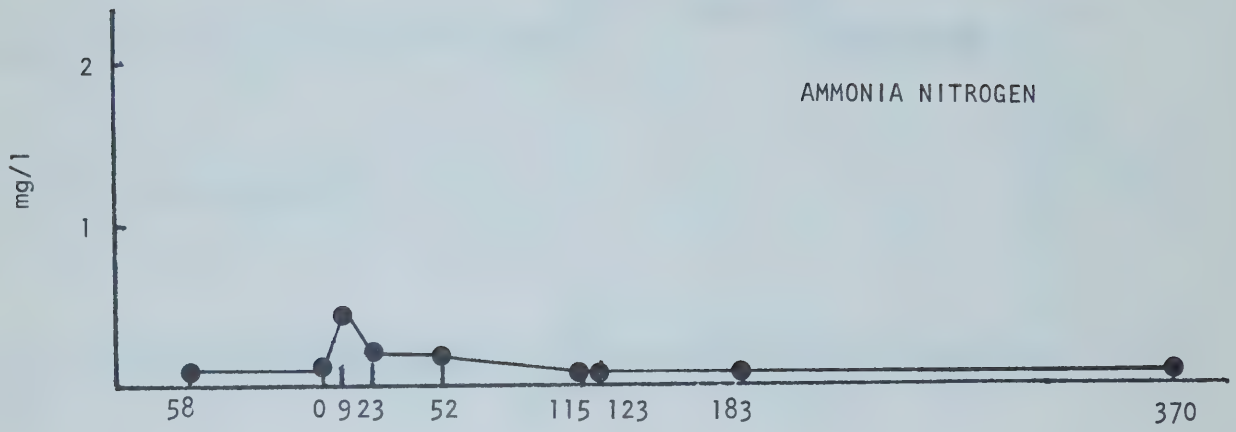

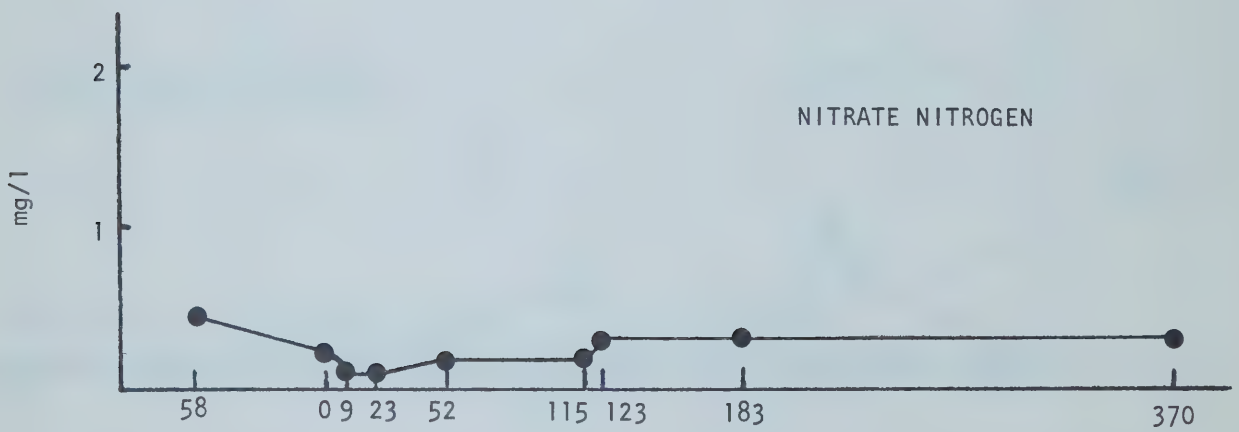

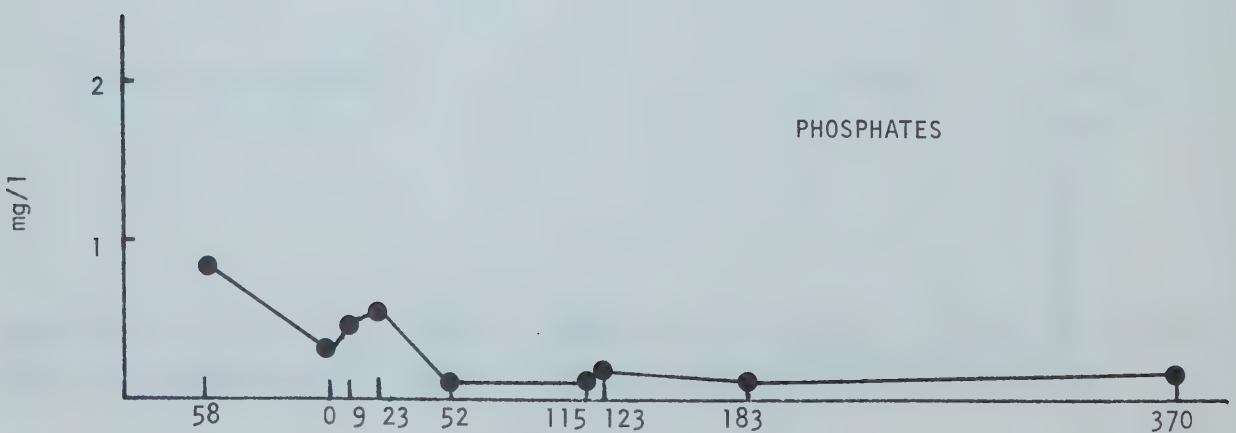

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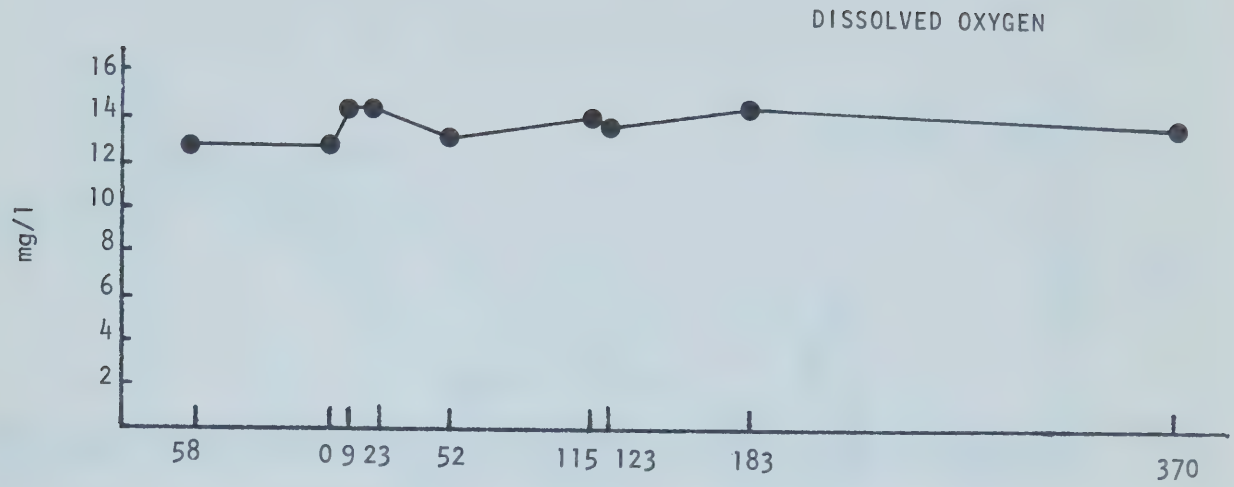

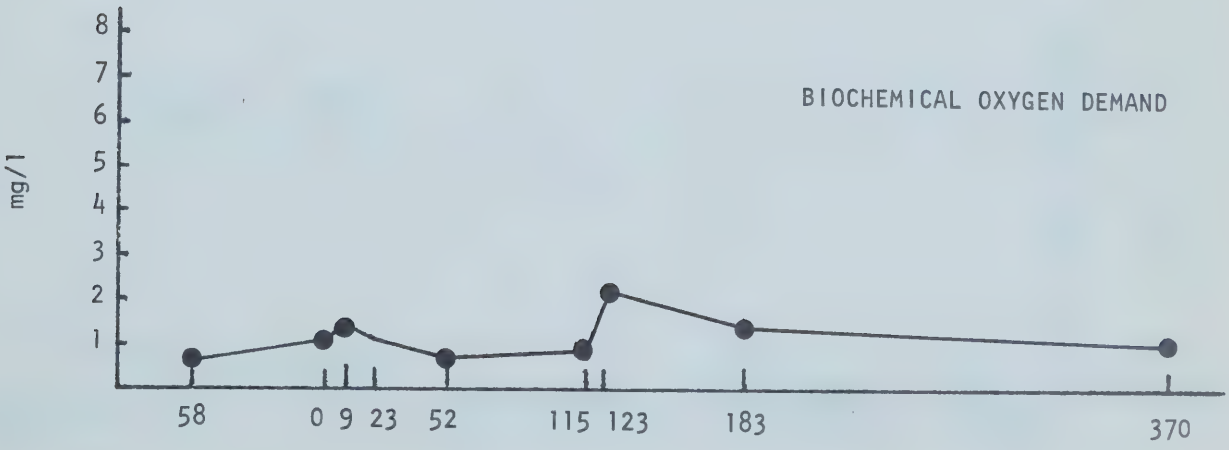

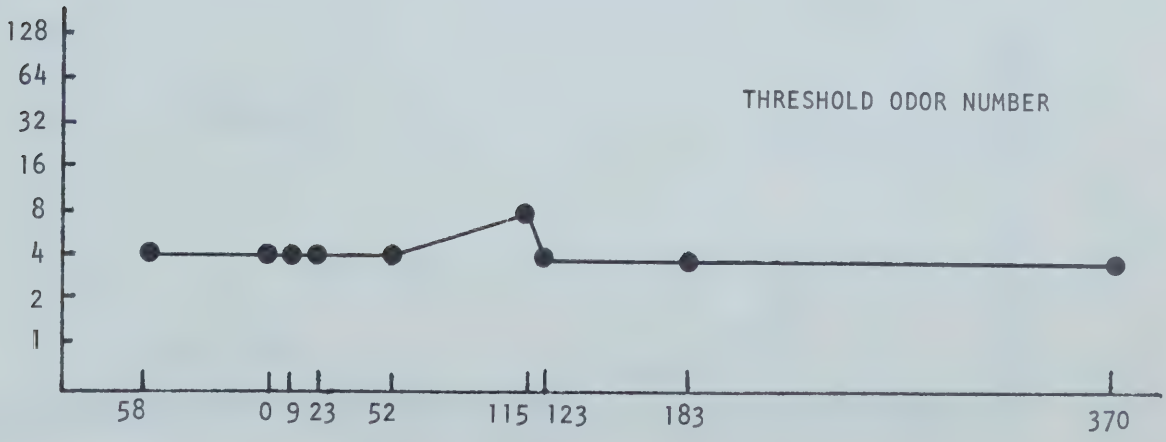

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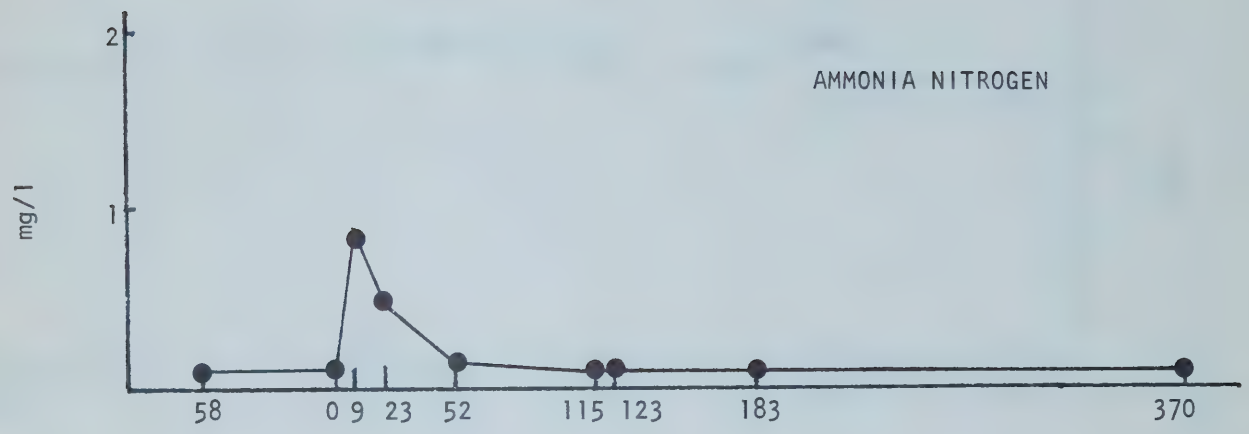
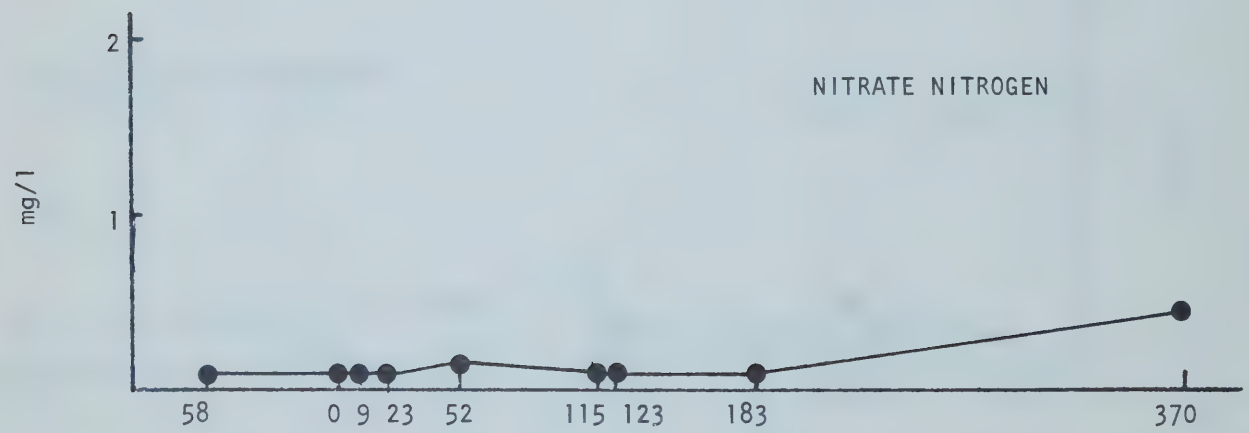
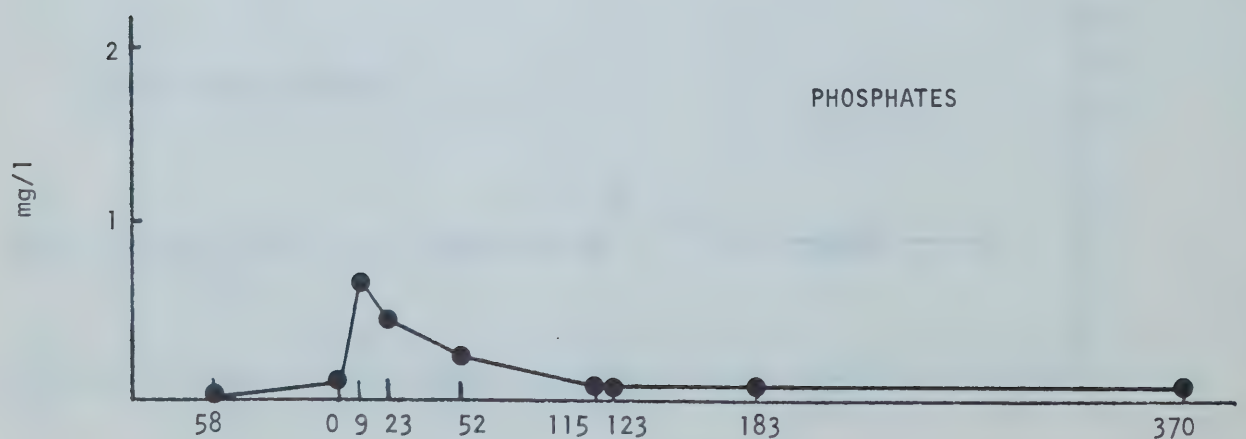
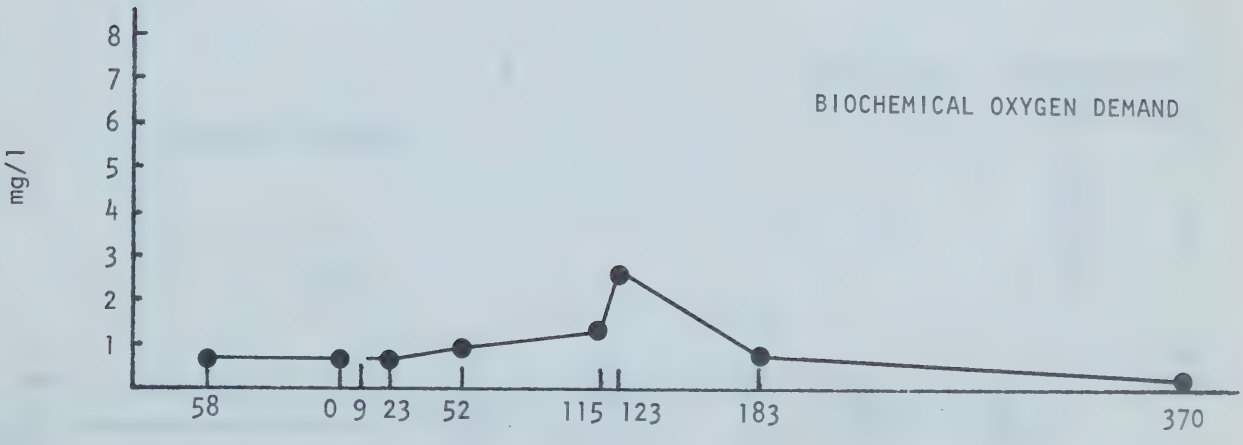


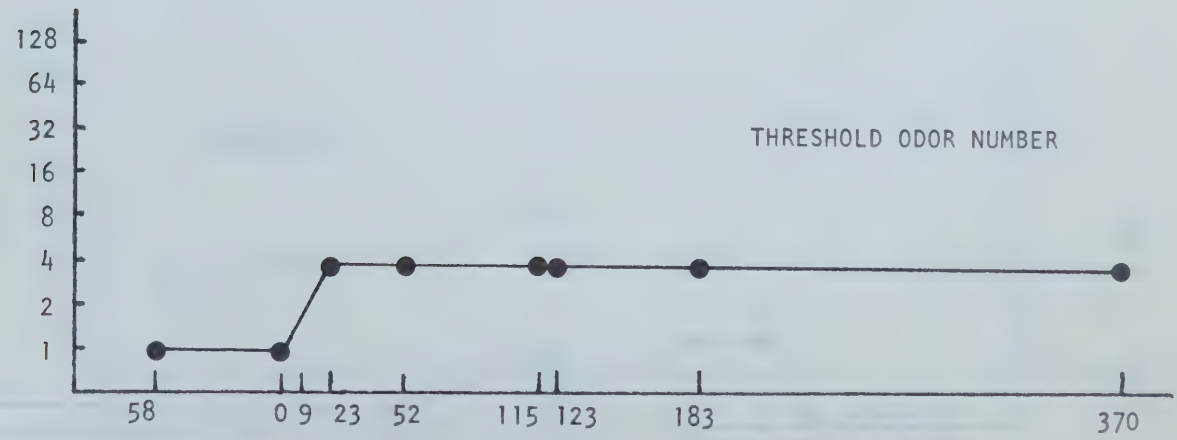




RIVER MILES FROM RED DEER

JANUARY 5, 1972





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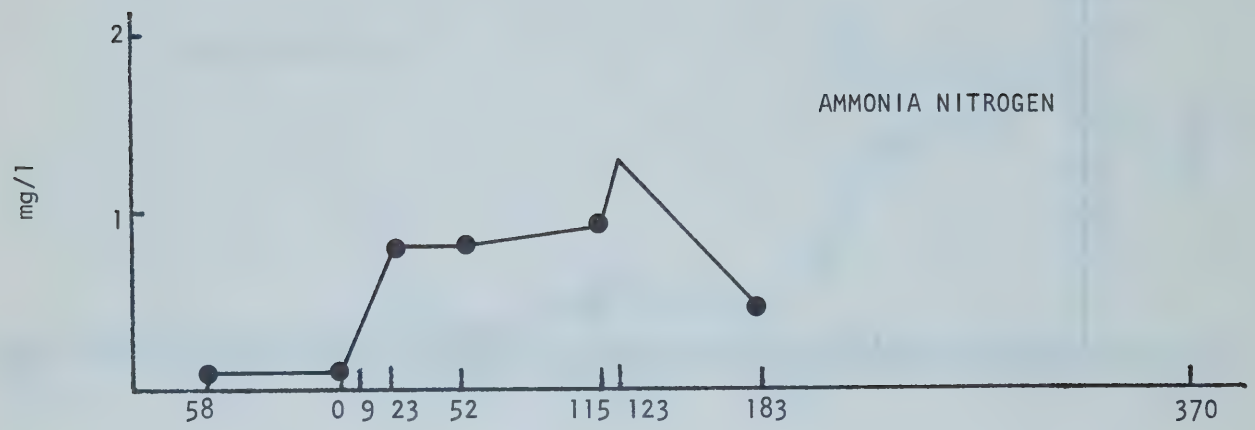
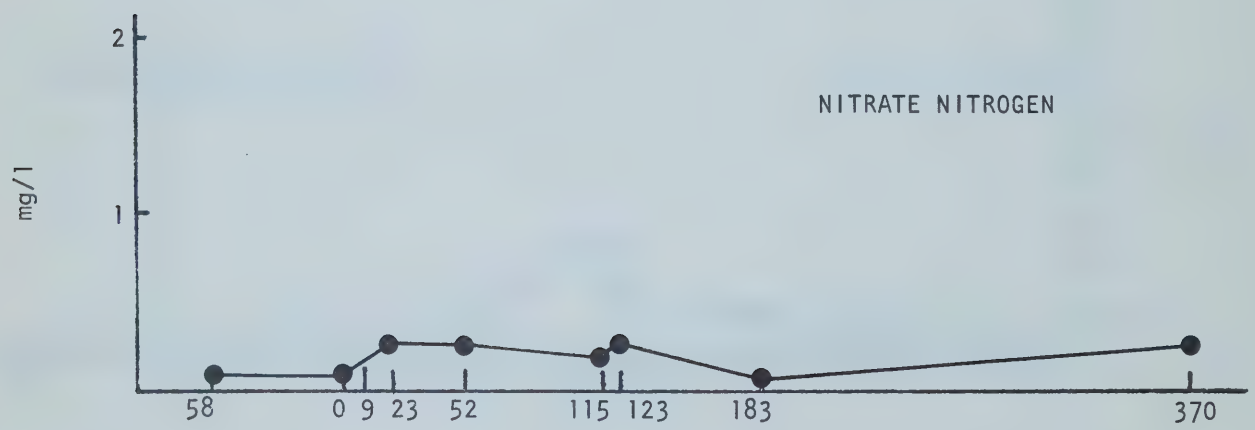
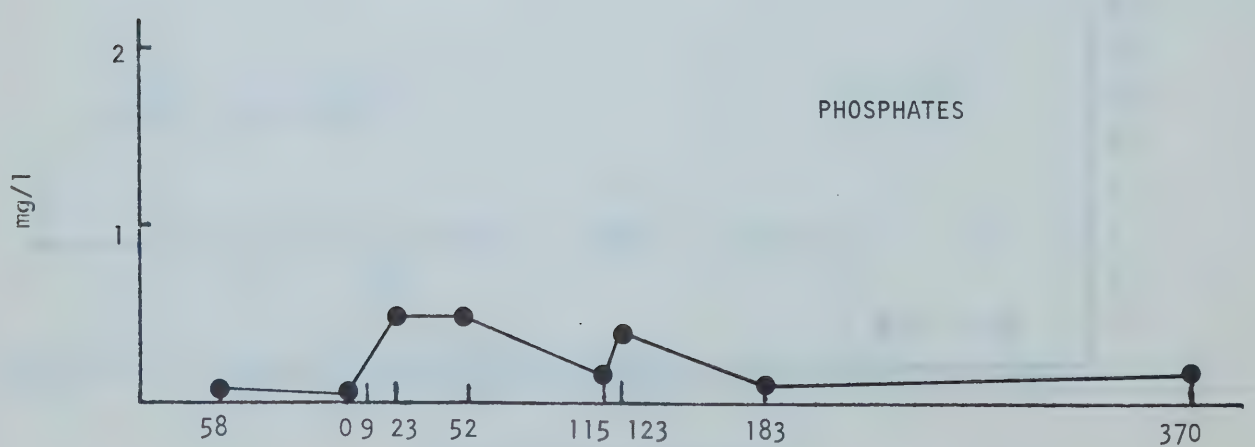
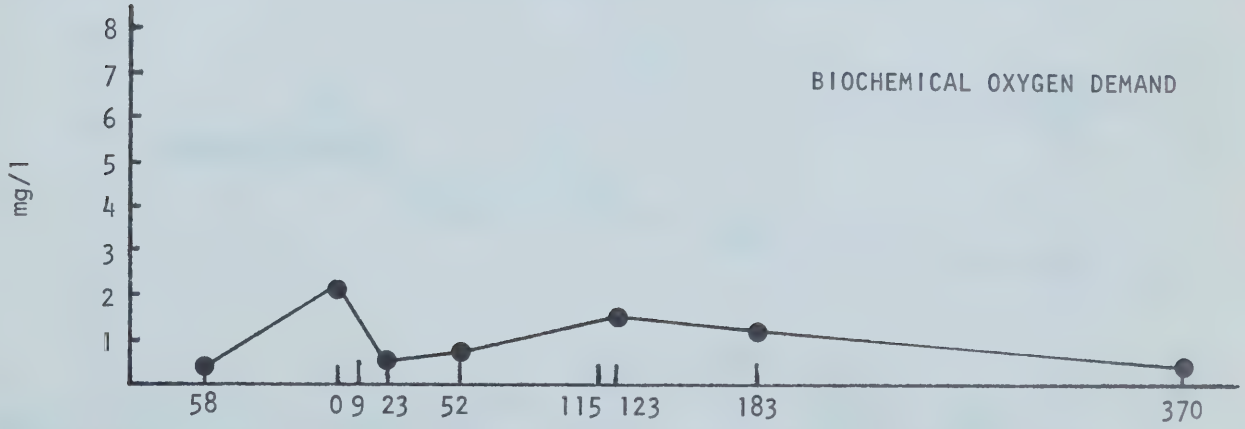


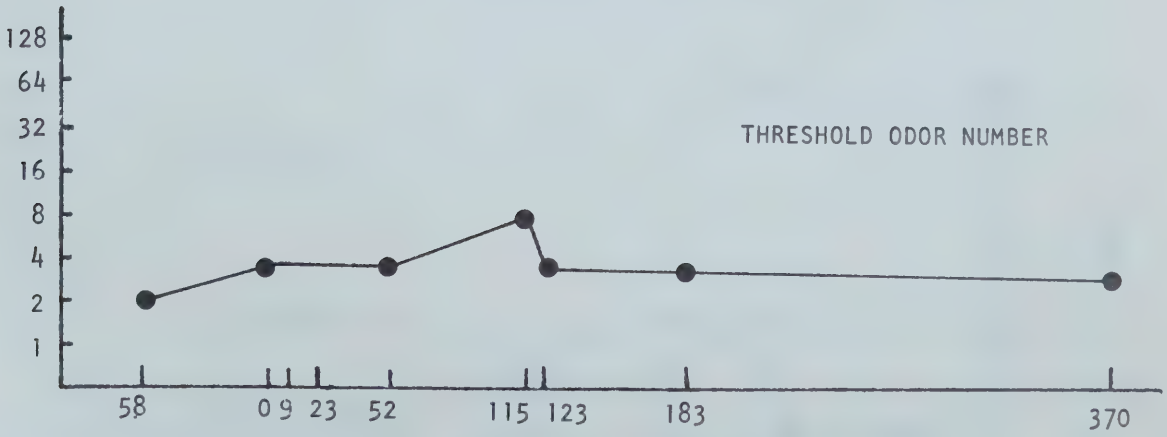




RIVER MILES FROM RED DEER

FEBRUARY 15-18, 1972





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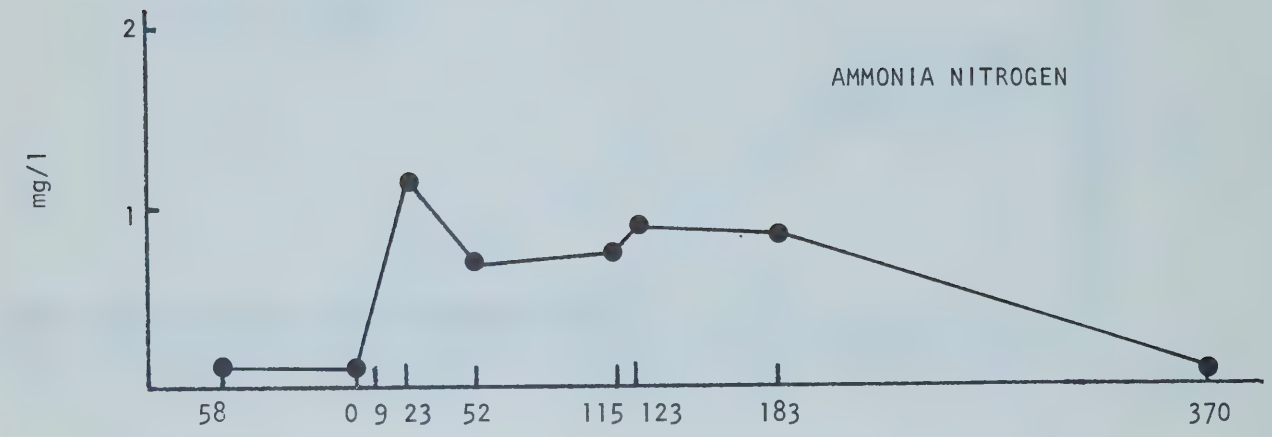
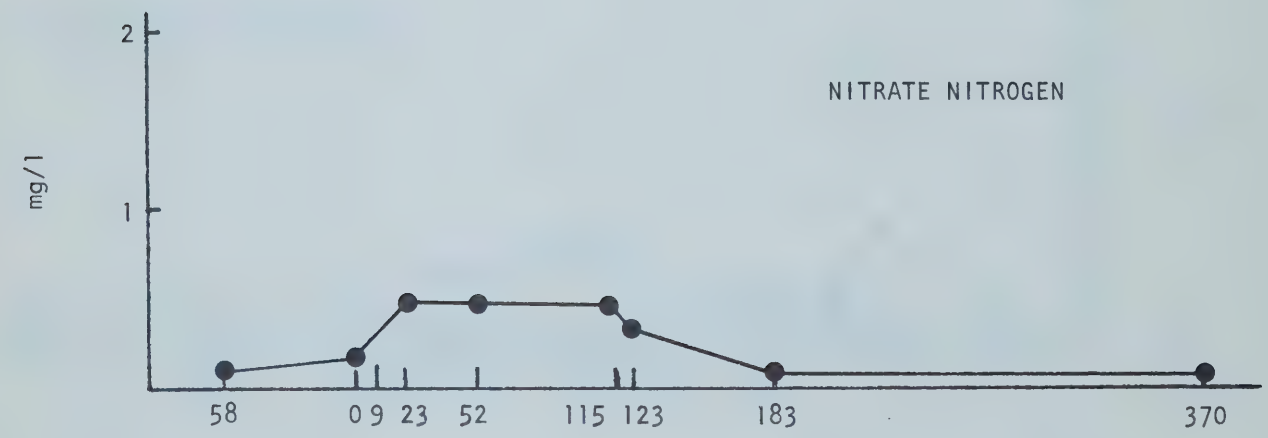
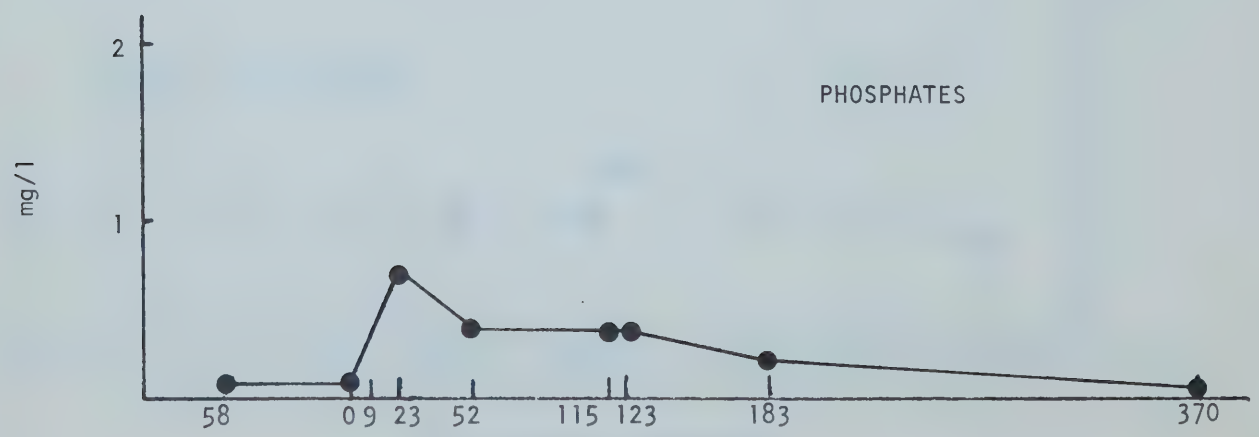
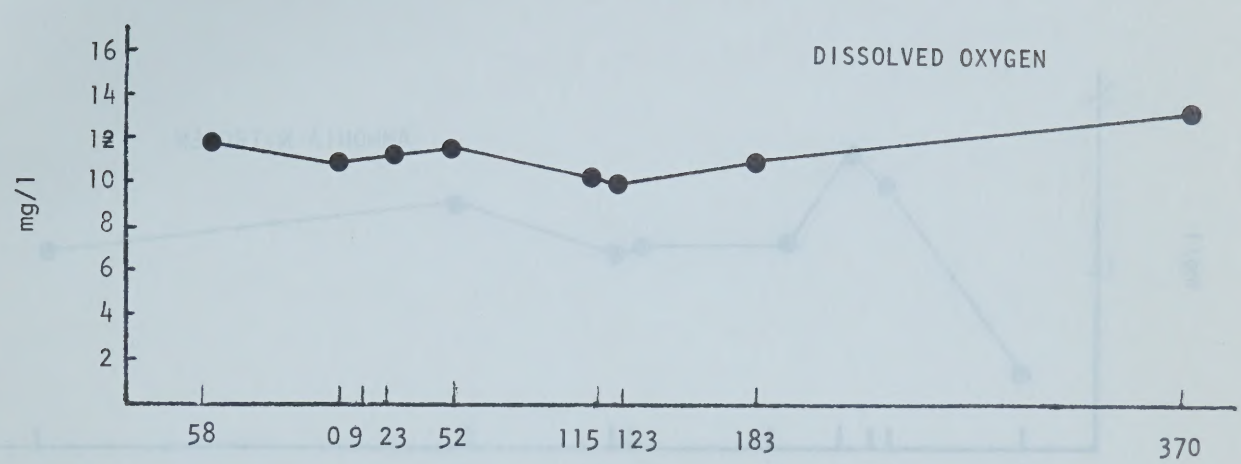


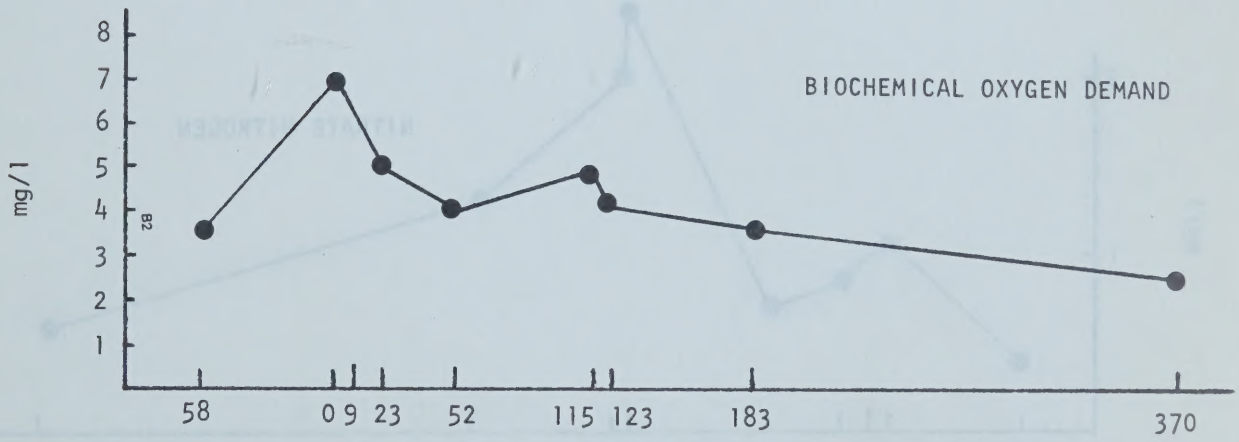


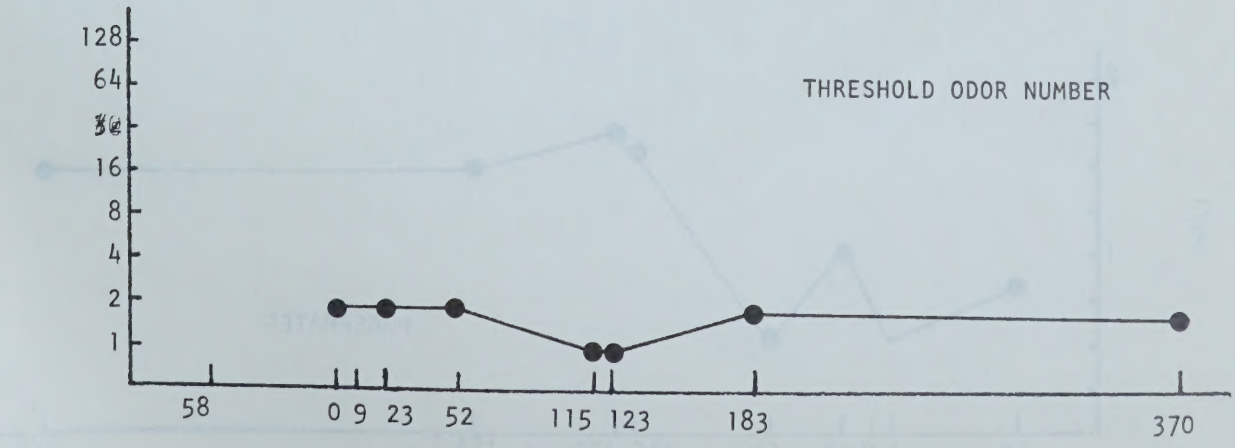


RIVER MILES FROM RED DEER

MARCH 21-22, 1972

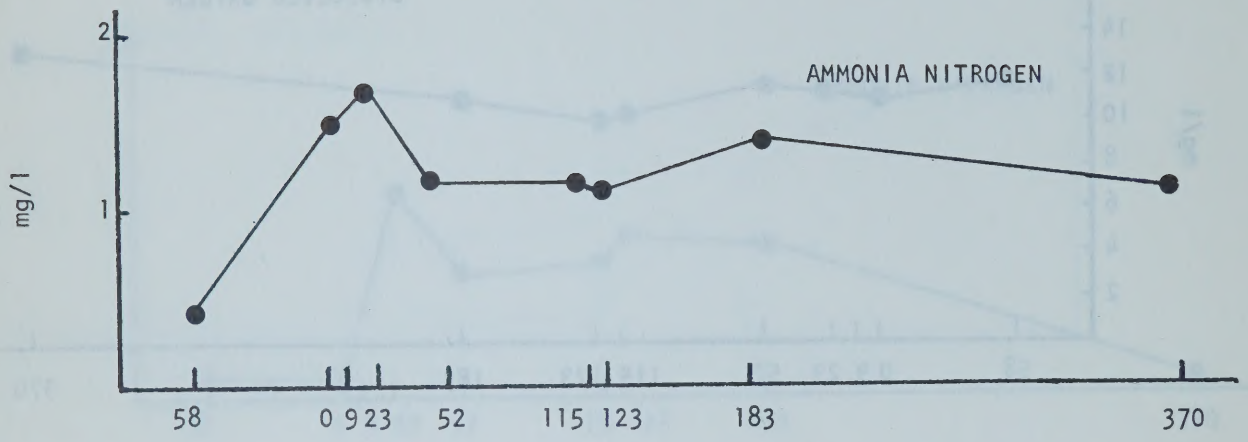


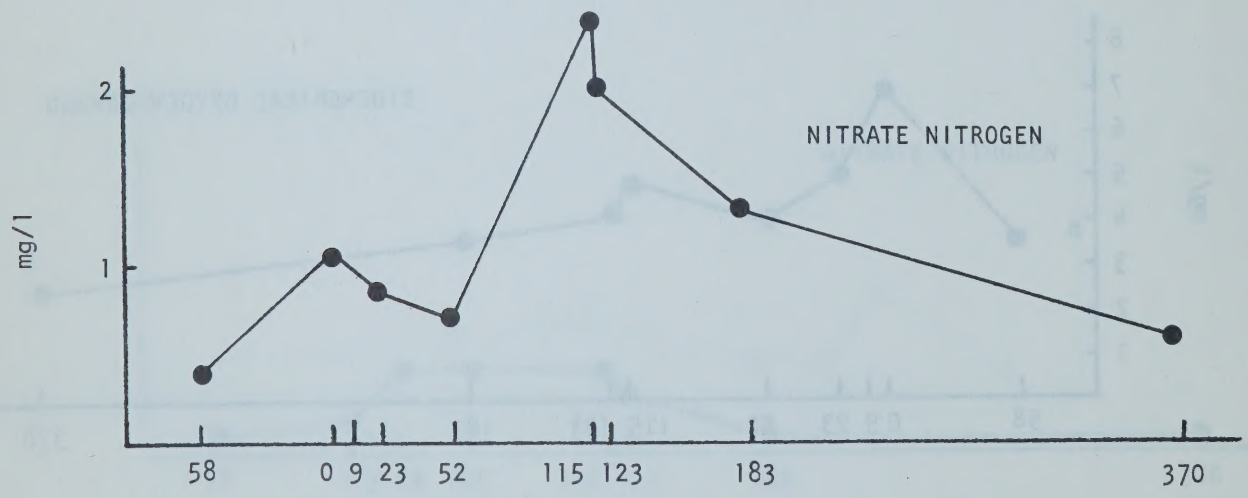


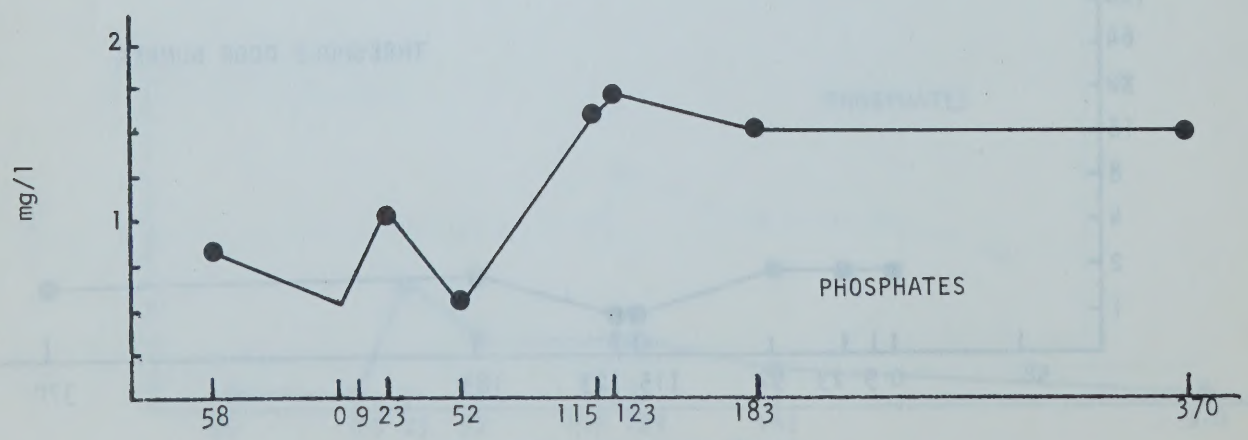


RIVER MILES FROM RED DEER

MARCH 21-22, 1972







RIVER MILES FROM RED DEER